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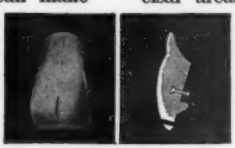

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EFFECT OF THE INTRODUCTION OF ANESTHESIA UPON SURGERY*

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The forties of a century ago were tumultuous years, when there was a pot of gold at the foot of every rainbow, and enterprise and imagination might be and often were extremely productive for the individual and society. During this time, the Mexican War opened up the Southwest for exploitation, while, by forceful negotiation with Great Britain, the Northwest territories were finally delimited and acquired. Horace Greeley's "Go West, young man" was the slogan of the period. Fortunately, not all young men followed his advice. Many sought advancement in the industrial surge in the East, at least as turbulent in Connecticut as elsewhere. So in Hartford, during this time, one would have heard talk of the damming of the river at Holyoke to provide power for a textile mill, of Goodyear and rubber, of Mr. Colt's new enterprise, of the railroad to New Haven, of Howe's sewing machine, of S. F. B. Morse's electric telegraph and, in quite another field, but none the less characteristic of the times, of Mrs. Sigourney, whose poetic tributes, as some one said, "added a new terror to death."

There might have been some talk too, in the winter of 1844, of the demonstration by a fellow named Colton of the use of "laughing gas" and its ludicrous effects, though this seemed of but ephemeral interest, a passing whimsey, good for a night's entertainment and nothing more. It is true that a young dentist by the name of Wells, who had been present one night at a demonstration, had had a tooth pulled the following day under the effects of the gas, but one surmises that this was passed off for the moment as a foolhardy stunt of no importance and, very likely, some worthy citizen remarked that there ought to be a law against such "monkeyshines." Dr. Wells proceeded to use the gas in his own practice during the following year or two and then moved to another community in the hope that he would find a wider opportunity for its exploitation. Meanwhile, in 1846, his erstwhile partner, Morton, succeeded where he had failed in a demonstration of what was shortly named anesthesia,

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using "sulfuric ether" at the Massachusetts General Hospital in Boston.

The aftermath of this event with its display of both human frailty and nobility, and moving like some Greek drama to tragic endings, needs no retelling, but the effect of the introduction of anesthesia upon surgery and secondarily on medicine has received but general and cursory attention. It is worthy of a detailed and documented investigation, which this abbreviated address cannot render, and awaits the attention of some competent historian. There are some aspects, however, on which I wish to dwell.

Surgery, in the first half of the nineteenth century, had arrived at a relatively static condition. The knowledge of disease, surgical pathology and the reaction to injury, following the impetus of John Hunter in England and Desault and his pupil Bichat in France, had led to a better understanding of what could be done; indeed, what should be done; but surgery remained to a large degree as in the previous century, a matter of necessity and of urgency. The removal of superficial tumors, the incision of abscesses, the ligature of arteries for hemorrhage and aneurysm, amputations, removal of sequestra and resection of diseased bone, herniorrhaphy in strangulation, cutting for stone, operations for cataract, cleft palate and harelip and an occasional trephining of the skull because of hemorrhage or necrosis pretty well covered the major procedures attempted as described in the standard operative surgery text of the period, Malgaigne's *Manuel de Médecine Operatoire*. The indications for operations were of the order of intolerable pain, blindness, complete disability or impending death. Short of these, the patient could rarely be induced to undergo the pain necessarily involved, and which the surgeon, one may well concede, was loath to inflict. As for the procedures, they were largely governed by the necessity of performance in the shortest possible time so that the suffering would be over as rapidly as possible. The objects were *sécurité, simplicité, célérité,* which might be paraphrased as carrying out the procedure as simply and rapidly as was consistent with the achievement of its purpose and the survival of the patient, in order that the pain of it might be minimized. This developed a type of surgeon who in his way was supreme, one skilled in anatomy, dextrous, or even ambidextrous, imperturbable and able to perform an operation with ferocious rapidity. Necessarily, the delicate handling of tissues and the scrupulous control of bleeding were not a part of the procedures.

One of the most skilful of such operators was Liston, of London, who carried out the first operation performed abroad under an anesthetic December 22, 1846. The description of the procedure is typical:

> Liston removed the thigh as rapidly as possible; a gentleman present, watch in hand, declared that the cutting operation lasted thirty-two seconds only. It was done by the antero-posterior flap method; the femoral artery was controlled by finger pressure; only three or four vessels required a ligature; lint dipped in water was placed between the flaps, and the stump folded in a towel and all signs of blood cleared away.

A second observer says:

> When unconsciousness was reached Liston completed the amputation at the thigh by the flap operation in twenty-eight seconds from the first thrust of the knife to the last touch of the saw. It had been arranged for the arteries to be tied after the patient had been carried from the operating table to an adjoining room, but his deep and quiet sleep continuing, the arteries were leisurely secured, and the flap closed. . . .

Such was the manner of operating developed to its highest degree in the days immediately preceding the use of anesthesia, and such the type of surgeon.

In Great Britain, Astley P. Cooper, Syme, Liston and Ferguson; in France, Larrey, Dupuytren, Velpeau and Malgaigne; in Germany, von Graefe and Langenbeck; in Russia, Pirogov, and, in America, Valentine Mott, S. D. Gross and John Collins Warren were outstanding examples. In Connecticut, Mason Fitch Cogswell, of Hartford, and Jonathan Knight, of New Haven, were notable.

In consideration of the ability and learning of these men, and many others less well known who were constantly and intimately concerned with pain, that it should have remained for those less well educated and informed to discover appropriate anesthetic agents, as they are called today, is astonishing. However, in the first place, there was no clear concept of anesthesia—the word suggested by Oliver Wendell Holmes after the use of ether had demonstrated the necessity for an appropriate term. Narcotics and sedatives such as preparations of opium, notably "laudanum," and alcohol, as in brandy, were well known and were used, and it was understood that these given separately or together could render a person unconscious; but, when so used, they were not infrequently lethal. Then too, the administration of drugs by inhalation, while not unknown, had fallen into disrepute because of the extreme claims as to the results obtained. Humphrey Davies, it will be remembered, described the action of nitrous oxide when inhaled and suggested that it be used for the abolition of pain during operative procedures. This was when he was a chemist at Beddoes' "Pneumatic Institution" for treating diseases by the inhalation of different gases, and it may be surmised that the failure of this, for the time at least, dubious, project served to discredit the administration of drugs by inhalation, including nitrous oxide. Also "mesmerism," a fad of the time, had been proposed and even successfully used in a few instances for relieving pain during operative procedures, but this likewise so savored of quackery that it never achieved standing. So many other ineffectual and "crack-pot" proposals had been made that the matter went by default, not for lack of ideas, but because, for one reason or another, the whole subject had fallen into discredit. So much was this the case that Velpeau, in 1839, said, "To escape pain in surgical operations is a chimera which we are not permitted to look for in our time." Yet, within five years, nitrous oxide was being used for the extraction of teeth and, in two years more, surgical anesthesia with ether was an accepted procedure, and Velpeau himself was one of the first to use it. The astounding thing was that this procedure was initiated by a young dentist, who presumably knew nothing of what had been attempted before; nor was he aware that the greatest surgeon of his time in Europe had said that it was impossible. Yet, with the assurance of the amateur, a general attitude of the forties, he put two and two together and turned surgery upside down.

The surgeons themselves, directly involved, turned Wells down after his unfortunate demonstration at Harvard, but accepted Morton's, to them unknown, agent, for trial, expecting this likewise to be a fiasco. At least, a willingness to experiment, an open mind and a swift recognition of the significance of their experience are greatly to their credit, most of all to John Collins Warren, who, in his declining years, retained sufficient mental elasticity to be a party to the procedures and, secondarily, to Henry J. Bigelow, who saw a loose ball in an open field and ran with it.

The ball, once started, carried itself under its own momentum. As we have seen, in less than a month after the publication of Bigelow's paper, Liston was using anesthesia in London and close on his heels was Simpson, employing

it in Edinburgh. It was carried to Germany and France nearly as rapidly and, in nine months, was being employed by Peter Parker in Canton, China. The rapidity of its dispersal, like that of influenza, was limited only by facility of transportation, and its acceptance was likewise epidemic in its proportions.

The beneficial effects of anesthesia were many. The fear of pain, which had prevented many patients badly in need of operations from submitting to them, was now in great part abolished. The surgeon, no longer embarrassed by the pain which he was causing, could proceed with greater care and deliberation, though it took many years and a new generation or two to abandon the rapid, rough and ruddy methods of preantisepsis days. Indeed, there was some tendency to be more heavy-handed, inasmuch as the patient no longer felt pain. The lack of struggling, the freedom from unexpected movements and the muscular relaxation enabled the operator to embark on more extensive and prolonged procedures, which before he would have considered not feasible. Thus, Spencer Wells performed 1,000 ovariotomies in the interim between anesthesia and antisepsis, probably many times more than the total of all such operations performed before 1850; and so was started the invasion of the abdomen.

An immediate effect was upon the hospitals, which, up to this time, had been, at best, glorified alms and fever institutions. At the Massachusetts General Hospital, in the five years preceding anesthesia, there were 184 operations; an average of thirty-seven a year, about three a month. In the five years after the introduction of anesthesia, 487 operations were performed, or nearly 100 a year, or eight a month. This expansion of surgery took place in all hospitals, and also, undoubtedly, in operations performed in private homes, which, until a generation ago, remained the custom for those who were not indigent. In institutions, the population of which had been composed in large degree of "fever patients," of the chronically ill and of incurables, with a scattering of traumatic cases, operations of election, as well as of necessity or urgency, became more and more common, so that the surgical wards were more crowded and were increased in number. Erichsen, of London, who lived through this period, says:

> The introduction of anaesthetics led at once to an enormous increase in the number of operations performed. Here hospital wards became more crowded than formerly with severe operative cases, and in the absence of any efficient antiseptic treatment the cases of septic diseases became much more rife, erysipelas, septicaemia, pyemia and hospital gangrene more frequent, and the mortality proportionately increased.

Mason Warren, of Boston, wrote, in 1864:

> I remember the time when, after an amputation or the excision of a breast or a large tumor, it was the universal rule to bring the edges of the cut integuments together mainly with straps, compress, and a bandage with the full assurance of finding the wound nearly healed at the removal of the dressing. At the present day, however, such a result is seldom attained in city practice; union by first intention being for the past twenty years the rare exception, suppuration almost always ensuing in the deeper parts.

J. Collins Warren, in his address as president of the American Surgical Association in 1896, recalled that:

> In about 1860, septic processes were rife at the Massachusetts General Hospital and the writer well remembers a virulent epidemic of hospital gangrene which got quite beyond the control of the surgeon. In the winter of 1867 and 1868, in Vienna, Billroth's wounds were full of pyaemia, erysipelas, and hospital gangrene, as the autopsy table but too frequently showed.

John Homans, in his classical report, in 1887, of "Three Hundred and Eighty-

Four Laparotomies for Various Diseases," with characteristic directness and honesty, wrote:

> Of my first five unantiseptic ovariotomies all died, of my antiseptic ovariotomies 248 have recovered and 34 have died. About one quarter, probably, of all the fatal cases are to be attributed to some error or carelessness of mine, to some want of cleanliness, or perhaps to a slightly suppurating hang-nail or other sore on my hands, or to something that might have been avoided. Perhaps this comes from too much operating within a given time. Deaths for which I am inclined to think I am at fault have occurred generally towards the end of many daily ovariotomies, when I have been tired or possibly unclean. . . . The causes of death have usually been Peritonitis and Septicemia.

The surgeon carried on his hands, instruments, clothes and dressings, from patient to patient, from operation to operation, and even from necropsy to patient, virulent organisms, as did the obstetrician, as had been pointed out by Holmes and Semmelweis. The shorter the interval of time and the distance, the greater the likelihood of transfer. One of the best examples of this was the conditions arising in military hospitals in the Crimean, Civil and Franco-Prussian wars. Where battles were infrequent and scattered, and the wounded therefore not congregated, and surgeons were not passing rapidly from one patient to another, sepsis was at a relatively low level, but, as in the Crimea, where a long siege was carried on, wounds were of daily occurrence, the wounded brought together in crowded wards and the same surgeons operating day after day, infection became rampant. According to Chisolm, the mortality for amputation of the thigh in the Confederate armies in 507 cases was 49 per cent, whereas, in the Crimea, in 1,664 cases, it was 92 per cent. While ether and chloroform were used in these wars, the conditions leading to frequent and severe infection were determined by the exigencies of the battle. The introduction of anesthesia into the surgery of civil life had, to a lesser degree, the effect of setting up similar conditions favorable to the increase of infections in surgical operations.

This, then, was the situation that Lister faced when, as a young surgeon, he "walked the wards" successively in London, Edinburgh and Glasgow. The problem of pain had been resolved, only to increase tremendously the problem of infection, and to the solution of this he bent his efforts, with a scientific background of training in physiology, and with the assistance of the knowledge accumulating in the rapidly developing field of bacteriology. In 1867, he published his first paper on the prevention of infections in compound fractures, thus introducing the second great advance in surgery, antisepsis, and enabling the surgeon to take full advantage of the first, anesthesia.

First, the abdomen was invaded; for, with the patient asleep and relaxed, and the danger of peritonitis greatly lessened, one could explore and carry out procedures with almost complete safety. One of the earlier manifestations of this was dependent on the concept of acute appendicitis introduced by Fitz, who suggested the removal of the appendix before it had gone on to general peritonitis or the formation of an abscess. With anesthesia and antisepsis, this became immediately possible, and the modern surgical treatment of acute appendicitis was established. Exploration of the abdomen led to the development of a "living" surgical pathology as contrasted with that applied on the necropsy table, and this, in turn, to a greatly increased knowledge of the natural history of the diseases occurring within the abdominal cavity. The surgical therapy of these followed closely, and now it was possible to carry out such procedures on animals before applying them in man.

The surgeon was no longer one who cared for urgent or superficial disease alone, but rather a person with technics that enabled him to become more learned in certain diseases amenable to his therapy than were his confrères who did not have this advantage. Consequently, a new generation of surgeons initiated an expansion in this field of medicine, such as had not been previously known and that probably will not occur again.

The same process, in more recent times, has gone on in respect to the central nervous system and the thorax, leading not only to the perfection of surgical technics, but, perhaps more important, also to a great expansion in the knowledge of certain diseases that occur there. With this have gone advances in anatomy, physiology and pathology.

To a lesser degree, but nevertheless significantly, the introduction of anesthesia and the development of an aseptic surgical technic have been followed by growth in the special fields of urology and orthopedics, and even in those specialties segregated from general surgery, ophthalmology and otolaryngology. Lastly, it is scarcely necessary here for me to dwell on the flowering of the surgical side of dentistry which, in its penultimate state of maxillofacial surgery, represents a marriage with general surgery in which it is at times difficult to determine which is the dominant mate.

With all this, anesthesia itself has undergone a development which Wells, imaginative as he was, could not have foreseen. His "laughing gas" is still with us and usefully so, but made possible of prolonged use by the addition of oxygen as introduced by Edmund Andrews in 1868, though it took a generation to perfect the mechanical apparatus so that the anesthetic was reasonably safe of administration over any considerable period. Notably among several gases added to it have been ethylene and cyclopropane, each with its particular field of application. Today, the machine for the administration of these gases compares with the original apparatus of Wells as does the latest airplane with the motor-glider of the Wrights, and is almost as confusing to the uninitiated. Sulfuric ether, or ethyl ether as we say today, and, to a much lesser degree, chloroform are still valuable anesthetics, which also have their specific indications. Many other and similar compounds have been tried, for a few of which there have become established specific indications. All these anesthetics are given by inhalation, and great advances have been made in the methods of their administration, such as rebreathing, pharyngeal administration and intratracheal intubation; the last of these contributing in no small part to the facility and safety with which the thorax can now be opened.

Other routes of administration of anesthetic or narcotic or strongly analgesic agents must not go unmentioned. First in importance in the development of local or block anesthesia, so useful in dental surgery itself, have been cocaine and its analogs. Discovered by Koller and first used for its analgesic action upon the mucous membranes of the eye and the nose and throat, it was tentatively tried by Corning for spinal anesthesia and by Halsted for block and local infiltration, proving too toxic for general use in this manner. With the development of several similar but less toxic agents, spinal, nerve block and local infiltration anesthesia have become common and valuable methods, again with their specific indications and limitations.

The analgesics, narcotics and hypnotics given by mouth or parenterally have a history long antedating the occasion that we memorialize today. "Hoffman's anodyne," the active ingredient of which is ethyl ether, paregoric, laudanum and paraldehyde, and many

other compounds or substances are relatively ancient remedies for pain or discomfort. Paraldehyde by mouth or rectum still is of value in particular situations either of itself or as an adjunct to more powerful agents, and the more recent use for "basal anesthesia" of tribromethanol (avertin) given by rectum is still acceptable in selected cases. This drug has been largely replaced by the various barbiturates, the development of which in relation to anesthesia has been phenomenal. The patient may now be brought to the operating room practically oblivious of his surroundings and with an amnesia as to what goes on there. The supplementary anesthesia that is required is minimal and the administration of it is facilitated. Most recent of all has been the introduction of intravenous sodium pentothal, particularly where the operative procedure is short and limited and immediate recovery from the anesthesia desirable.

With amplification of the choice of anesthetic agents, the introduction of extensive preoperative medication and the development of many variations in the technical phases of administration, the field has become a highly specialized one, requiring much in the way of materials and apparatus and special skill. Out of this is arising rapidly a new and worthy specialty, that of anesthesia, comparable in all respects to the other major divisions of surgery.

* * *

It was a small flame that Horace Wells lighted in this community one hundred years ago, and it seemed at first about to flicker out; but it proved to be a spark thrown into tinder, and the resulting conflagration has changed medicine and surgery as few other contributions have done. As the years pass, the name of Wells and what he did here will become increasingly recognized, making an historical landmark indicative of another epoch in the advance of the applied science of medicine.

A CLINICAL STUDY OF MALNOURISHED EDENTULOUS PATIENTS*

Arvin W. Mann, D.D.S., Jane M. Mann, R.N., and Tom D. Spies, M.D., Birmingham, Ala.

Perlèche, or angular cheilosis, as it has come to be known, is a lesion occurring at the corners of the mouth. (Fig. 1.) It begins as a pale, wet patch at the corners and spreads along the vermilion border of both lips. The result is a triangular lesion following the skin fissures and extending 1 to 2 cm. laterally beyond the normal mucocutaneous border. The tissue at the angles remains wet and macerated and is oftentimes covered with a slightly adherent grayish yellow crust. After a varying period of time, the macerated tissue tends to disappear, leaving a slick, wet red area at the corners of the mouth. The lesions may remain indefinitely or may heal, leaving

*University of Cincinnati Studies in Nutrition at the Hillman Hospital, Birmingham, Ala. (From the Department of Internal Medicine, University of Cincinnati.) The expenses of the general nutrition study have been borne by grants from a number of philanthropic persons, foundations and commercial concerns, without which this study could not have been made. The expense of numerous observations and material used in treating these patients over a long period of time has been defrayed by grants from the Martha Leland Sherwin Fund and White Laboratories.

Fig. 1.—Angular cheilosis. There were triangular patches at both angles.

scar tissue at the site of the old lesions that have been inactive for some time. This scarring occurs more frequently in adults than in children.

Angular cheilosis has been associated in etiology with three conditions.[1-8] The

1. Ellenberg, M., and Pollack, H.: Pseudo Ariboflavinosis. J.A.M.A. 119:790-792, July 4, 1942.

2. Spies, T. D.; Mann, A. W., and Springer, F. M.: Preliminary Report on Effect of Mechanical Increase in Vertical Dimension of Face in Angular Cheilosis. J. D. Res. 21:305-306, June 1942.

3. Finnerud, C. W.: Perlèche: Its Nosologic Status. J.A.M.A. 126:737, November 18, 1944.

4. Smith, S. G., and Martin, D. W.: Cheilosis Successfully Treated with Synthetic Use of Vitamin B_6. Proc. Soc. Exper. Biol. & Med. 43:660, April 1940.

5. Riddle, J. W.; Spies, T. D., and Hudson, N. P.: Note on Interrelationship of Deficiency Diseases and Resistance to Infection. Proc. Soc. Exper. Biol. & Med. 45:361-364, October 1940.

6. Sebrell, W. H., and Butler, R. E.: Riboflavin Deficiency in Man: Preliminary Note. Pub. Health Rep. 53:2282, December 30, 1938. Riboflavin Deficiency in Man (Ariboflavinosis). Pub. Health Rep. 54:2121, December 1, 1939.

7. Spies, T. D.; Vilter, R. W., and Ashe, W. F.: Pellagra, Beriberi and Riboflavin Deficiency in Human Beings. J.A.M.A. 113:931, December 1, 1939.

8. Spies, T. D., et al.: Endemic Riboflavin Deficiency in Infants and Children. Am. J. M. Sc. 200:697-701, November 1940.

first of these is a decrease in vertical dimension of the face. If the normal vertical dimension is not restored when the natural teeth are replaced by complete dentures, a sag of the facial muscles causes the formation of deep fissures at the angles of the mouth. The retention of saliva and food in the depths of these fissures provides an excellent medium for bacterial and mycotic growth. A decrease in vertical dimension also occurs when alveolar resorption causes a settling of dentures worn for long periods without rebasing or when patients go without either the upper or the lower denture.

The second possible factor in perlèche is a local infectious process. Although many early workers have shown that yeast and other fungi contribute to perlèche,[3] Riddle, Spies and Hudson[5] have also shown that cultures and smears taken from cheilotic lesions contain large numbers of the hemolytic *Staphylococcus aureus* and *Streptococcus hemolyticus*. There is some evidence that infections at the site of angular cheilosis are secondary rather than primary etiologic factors in the lesion, since they tend to disappear after therapy has been instituted.

The third factor in the etiology of angular cheilosis is chronic hypovitaminosis. Finnerud[3] states that perlèche, when associated with "avitaminosis," is usually caused by a deficiency of riboflavin in the dietary. Some reports have been presented that a deficiency of niacin and pyridoxine may be an important factor. Smith and Martin[4] reported a healing of this lesion with pyridoxine. Sebrell and Butler,[6] Spies, Vilter and Ashe[7] and Spies, Bean, Vilter and Huff[8] believe that a deficiency of riboflavin is usually the chief dietary factor in angular cheilosis.

A legitimate difference of opinion still exists as to the relative degree of importance of mechanical factors, infectious processes and hypovitaminosis in the formation and maintenance of angular cheilosis. Ellenberg and Pollack[1] have shown that angular cheilosis can occur in well-nourished patients whose ill-fitting dentures failed to restore correct vertical dimension. Such lesions completely disappeared when vertical dimension was restored to normal by mechanical measures. In a group of malnourished patients with decreased vertical dimension, selected from this clinic, angular cheilosis was improved by correcting only the mechanical factors, but in no instance was a full cure obtained until riboflavin therapy was also instituted.[2] These and other, unpublished observations by Spies and Vilter[9] have caused the authors to develop the working hypothesis that cheilosis is a clinical term denoting a lesion that may be relieved by a number of agents.

The present study was undertaken to determine the incidence of decrease in vertical dimension of the face in a large group of malnourished patients. These patients had been edentulous for a period of time varying from one to twenty-five years. No attempt was made to alter *permanently* the existing vertical dimension in the denture cases studied. All measurements were taken with the patient's existing dental appliances in place. It was the purpose of this study to find the relation of a decrease in vertical dimension to angular cheilosis and alimentary tract complaints by determining the incidence of all of these factors in a group of malnourished edentulous patients.

Material and Methods

One hundred and sixty edentulous patients with long-standing clinical records of multiple deficiency disease were selected arbitrarily in the Nutrition Clinic of the Hillman Hospital, Birmingham, Ala. All had a past history or present evidence of chronic pellagra,

9. Spies, T. D., and Vilter, C. F.: Unpublished data.

Fig. 2.—Dentures in place and in occlusion; extreme bite closure causing forward thrust to mandible. The sag of the muscles around the nose and mouth and tension of the muscles of the neck are evident.

beriberi, scurvy and riboflavin deficiency. This was substantiated by the presence of characteristic mucous membrane and dermal lesions of pellagra, of angular cheilosis and ocular lesions of riboflavin deficiency, of nutritional peripheral neuritis of beriberi and of gingival lesions of scurvy.[10, 11] All patients had been under observation for at least three years prior to their selection for this study.

The vertical dimension of the face is directly influenced by the positional relation of the mandible to the maxilla in occlusion and at rest. When a full complement of natural teeth is present without abrasion and in normal occlusion, the vertical dimension may be considered to be normal for that individual. After full-mouth extraction, the normal vertical dimension is lost. If this maxillomandibular relationship is not restored by well-constructed artificial dentures, the decrease in vertical dimension of the face remains. The amount of decrease could not be accurately measured in the group of seventy-four patients who were not wearing both dentures, but all patients in this group showed varying degrees of bite closure. In the eighty-six patients wearing both dentures, correct vertical dimension of the face was temporarily established by phonetics and by

10. Spies, T. D.: Tr. & Studies Coll. Physicians Philadelphia 8:12-26, April 1940.

11. Spies, T. D.; Cogswell, R. C., and Vilter, C. F.: Detection and Treatment of Severe Atypical Deficiency Disease. J.A.M.A. 126:752, November 18, 1944.

Fig. 3.—Correct vertical dimension established with bite-blocks and dentures in place. The mandible has been restored to correct the maxillomandibular relationship. The change in general appearance, with elimination of wrinkles and deep skin fissures around the mouth, is noticeable.

establishing a harmonious facial appearance. Any variation from normal of the existing vertical dimension could then be measured.

A modification of the methods suggested by Grubb,[12] Loughry[13] and Bodine[14] was used to measure the vertical dimension. Soft green compound was softened by wet heat and formed into blocks 2.5 cm. in height. These compound blocks were luted to the occlusal surface of the molar denture teeth by heating the adjacent surface of the compound. Both dentures were then placed in the mouth and phonetic values recorded while the compound was still soft. The patient was instructed to emphasize the s sound by repeating words such as Mississippi and six-sixty-six until a clear ess rather than an eth or esh sound was produced. To prevent the compound from interfering with normal tongue movement, the blocks on the lingual surface were trimmed. This test was repeated several times by rebuilding the bite-blocks with soft compound and having the patient repeat the "ess" phonetic sound until a uniform result was obtained. The patient's correct vertical dimension was thus temporarily established. (Figs. 2, 3, 4.) To determine the decrease in vertical dimension, the blocks

12. Grubb, H. D.: Personal communication to the authors.

13. Loughry, J. A.: Personal communication to the authors.

14. Bodine, T. A.: Personal communication to the authors.

were removed and measured by the following method: The distance between the central fossa of the upper first molar and the occlusal surface of the distobuccal cusp of the lower first molar was measured by locating the impression of these points in the compound and measuring the distance between them with a Boley gage. When the first molars were missing, the distance was measured between the impressions of the second molar of the denture. This distance represented the decrease of vertical dimension in the dentures tested. (Fig. 4.) A decrease of 1-3 mm. was considered to be within normal limits, while anything over this was considered a decrease in vertical dimension.

Fig. 4.—Dentures with bite-blocks in place; showing distance between dentures in correct vertical dimension position. There is loss of the upper right first bicuspid and first molar denture teeth because of deterioration of the denture base material. These dentures have been in use for twenty-five years.

Observations

The vertical dimension was found to be decreased in 140 of the 160 cases studied. Sixty-six of the 140 patients were actually wearing both dentures, while twenty-two had only one denture and fifty-two had no dentures at all. Thus, only twenty of the total of 160 patients were wearing dentures which restored the vertical dimension to normal. (Fig. 5.) Analysis of the sixty-six cases in which the patients were wearing both dentures but nevertheless had a decreased vertical dimension revealed the following data: the bite was closed 4-7 mm. in twenty-five patients, 8-11 mm. in thirty-five patients and over 11 mm. in six patients. (Fig. 6.)

Angular cheilosis was found to be present in 120 of the 160 cases studied. (Fig. 5.) This lesion varied from a wet macerated area extending out on the surface of the lips to a small scar or eroded crack at both angles of the mouth. The highest incidence of angular cheilosis was noted in the group of patients who were wearing only one denture or none at all. Fifty-seven of the seventy-four patients in this group were found to have angular cheilosis. A similar high incidence of cheilosis was noted in the patients wearing both dentures with decreased vertical dimension. Fifty-two of the sixty-six cases in this group gave evidence of angular cheilosis. In sharp contrast, only seven of the twenty cases with a normal vertical dimension showed any angular cheilosis. (Fig. 7.)

One hundred twelve of the 160 patients studied complained of symptoms arising from the alimentary tract: burning of the mouth and tongue, epigastric burning and pain, nausea and vomiting, intermittent diarrhea, cramping and anorexia. The highest incidence of these symptoms was found in the group of patients with decreased vertical dimension. Fifty-five of the seventy-four patients in the group either without dentures or with only one denture and forty-three of the sixty-six patients in the group wearing full dentures that failed to restore correct vertical dimension complained of digestive tract symptoms. In striking contrast, only eight of the twenty patients with a normal vertical dimension complained of any such symptoms. (Fig. 8.)

Repeated questioning revealed that 105 of the 160 patients lost their teeth

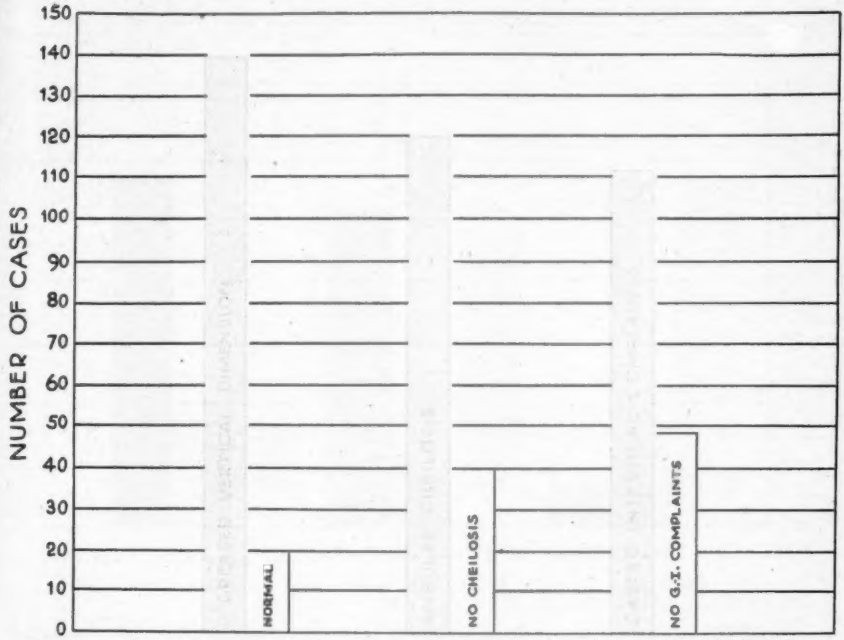

Fig. 5.—High incidence of decreased vertical dimension, angular cheilosis and alimentary tract complaints and similarity in ratio of abnormal to normal cases of these three conditions (160 cases).

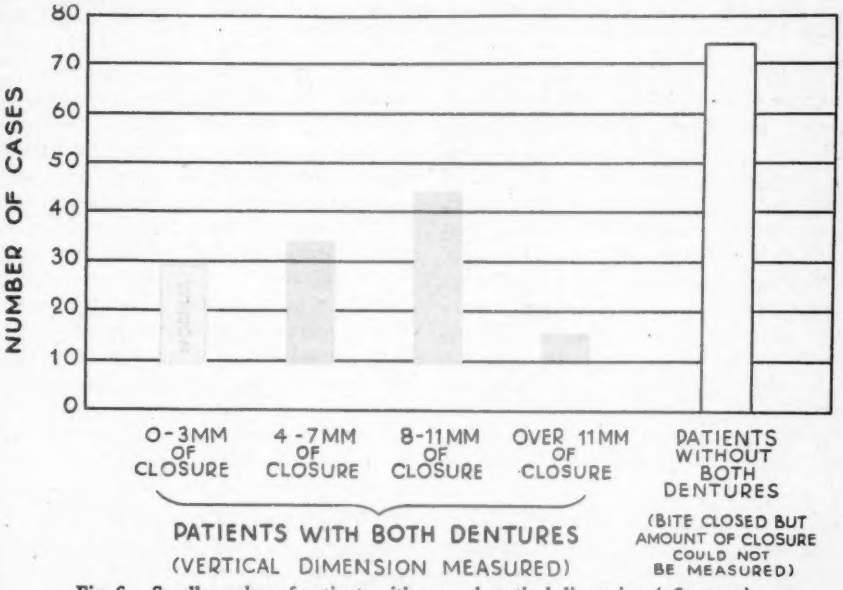

Fig. 6.—Small number of patients with normal vertical dimension (160 cases).

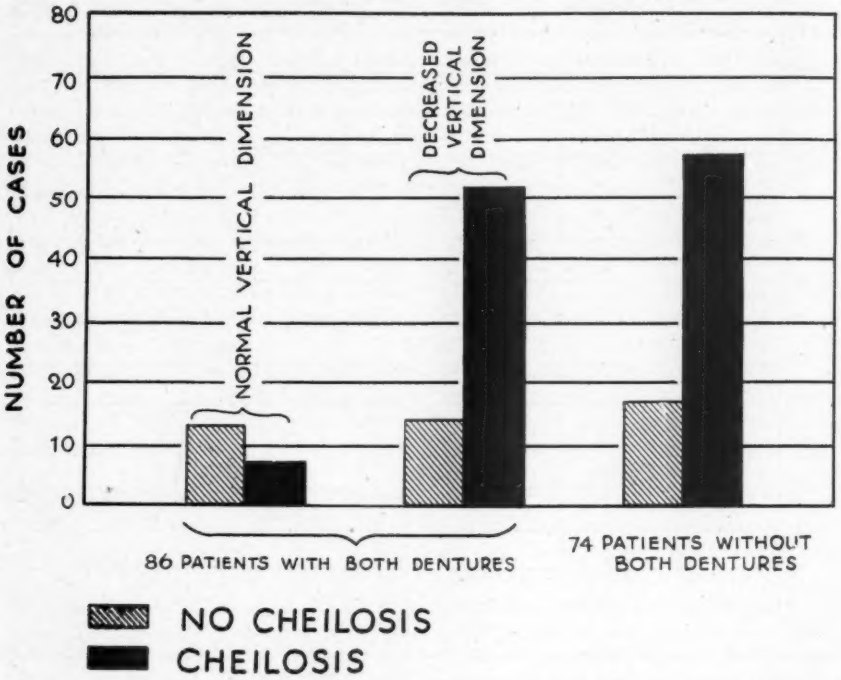

Fig. 7.—High incidence of cheilosis in patients with decreased vertical dimension in contrast to low incidence in normal vertical dimension group (160 cases).

because of a breakdown of the periodontium (pyorrhea). Patients frequently referred to their teeth as having become so loose that they had extracted many of them with their own fingers. Three cases were noted wherein the patient's first visit to any dentist was for full denture impressions as he had extracted all of his own teeth. It is also interesting to note that repeated examination of patients with natural dentures in the nutrition clinic showed a similar tendency toward periodontal breakdown.[15, 16] This is particularly true when evidence of deficiency disease has been present for several seasons. In sharp contrast to this high incidence of pyorrhea, only twenty-nine of the 160 patients lost their teeth because of dental caries, twenty-one patients because of hypersensitive teeth or on the advice of their physician in systemic illness and five because of periapical infection.

Allen,[17] in an analysis of the extraction of 1,424 teeth at the University of Michigan Dental School Clinic, presents the antithesis of these findings. He states that teeth were extracted as a result of dental caries in 59 per cent of the patients studied and that only 13 per cent of the patients had their teeth extracted because of periodontal disease. The re-

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16. Bean, W. B.; Spies, T. D., and Blankenhorn, M. A.: Secondary Pellagra. Medicine 23:1, February 1944.

17. Allen, E. F.: Statistical Study of Primary Causes of Extractions. J. D. Res. 23: 453-458, December 1944.

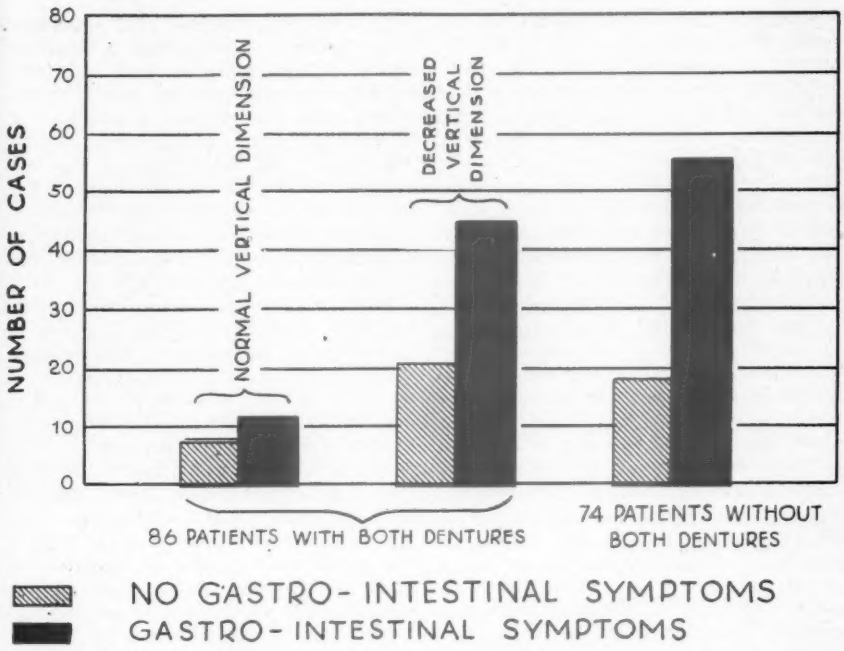

Fig. 8.—Incidence of gastro-intestinal symptoms in 160 edentulous cases. Just as there was a high incidence of cheilosis in patients with decreased vertical dimension, as shown in Figure 7, so is there a high incidence of alimentary tract complaints in patients with decreased vertical dimension as shown here.

maining 28 per cent had their teeth extracted for other reasons.

Twenty-two of the 160 patients selected were wearing only one denture because they had broken either the upper or the lower of the original pair. Fifty-two either had lost both artificial dentures or had never had any constructed. Masticatory function was possible in these seventy-four patients only by the articulation of one denture with the opposing alveolar ridge or the articulation of both alveolar ridges.

Most of the artificial dentures were poorly constructed and of inferior materials. In many cases, the deterioration of the denture base material by constant immersion in saliva caused some of the diatoric teeth to loosen and fall out. (Fig. 4.) It also produced a rough granular surface, which irritated the oral mucosa. This irritation was undoubtedly aggravated by the unsanitary condition of these appliances. Furthermore, over the years, alveolar resorption had permitted settling of the dentures, causing the periphery to traumatize the oral mucosa even though the dentures originally had been constructed correctly.

The esthetic and functional qualities so necessary in artificial dentures were in most instances completely lacking. This, combined with the poor construction and fit of most of these dentures, makes it logical that deficiency syndromes be established and maintained in these patients. The following is a report of a representative case.

Mrs. E. I., aged 56, came to the nutrition clinic October 2, 1942, because of a sore

mouth and tongue. She complained that the angles cracked open, bled and became so sore that she could not eat. Her tongue felt scalded and was extremely sensitive to hot and spicy foods. (It is interesting to note that patients frequently come to the nutrition clinic seeking relief from a sore mouth. The tongue, lips, angles, gingivae and even the teeth themselves are frequently so sensitive that it is impossible to have an adequate diet. This certainly emphasizes that dentists should be on the alert for any oral abnormalities suggesting dietary disease.)

There was a history of suffering with a sore mouth and tongue intermittently for twenty-two years. The patient had less discomfort in winter and more pain and soreness during the spring and summer months. The tongue and lips frequently felt as if they had been scalded. Small ulcers were noted at the tip and along the lateral border of the tongue, in the mucosa of the cheeks and on the vermilion border of the lips. The patient complained that her mouth cracked at the corners and that her eyes felt "like they had a skim over them." Choking and smothering sensations were also noted. The patient frequently was nauseated after eating and experienced a sensation of pin pricks and electric shocks in the mouth at that time. She complained of feeling nervous and "trembly" and of being easily excited. She also noted pain in her legs, weakness and parasthesia, especially around the ankles.

Physical examination revealed wet macerated cheilotic lesions at both angles of the mouth. (Fig. 1.) The bulbar conjunctiva was injected, especially in the exposed areas. The tongue was red at the tip. Lingual papillae were atrophic and an ulcer 1 mm. in diameter was noted on the left lateral border of the tongue. Evidence of old pellagrous dermatitis was observed on the hands, forearms, legs and feet. Neurologic examination revealed normal knee jerks, decreased ankle jerks and diminished perception of vibration in the feet and legs.

The appetite had always been poor and the patient had not had meat or milk for the last twenty-five years. The nutrition history showed the diet to be deficient in almost all essential nutrients. There was difficulty in masticating any food because of ill-fitting, defective dentures. The teeth had been extracted twenty-five years earlier because of periodontoclasia (pyorrhea). Full upper and lower vulcanite dentures were constructed six weeks after extraction and had been worn for the last twenty-five years. At the present time, they did not in any way fit the alveolar ridge. The vulcanite in the denture base had deteriorated so that the outer surface was rough and irritated the oral mucosa. To counteract this and perhaps to increase the vertical dimension sufficiently to make masticatory function possible, the patient habitually lined the tissue side of the denture with cotton. Several denture teeth had been lost because of this deterioration of the denture base material. The vertical dimension was found to be decreased 11 mm. on both sides when measured by the method outlined in this paper. The masticatory function was manifestly inadequate.

The patient was given 5 mg. of riboflavin every day for five months on two different occasions. Both ocular symptoms and cheilotic lesions were greatly improved by this medication, but at no time did the treatment result in a complete healing of the angular cheilosis. The patient also received 100 mg. of nicotinic acid three times a day for two months. Cheilosis was unchanged by this medication, although the burning and scalding of the tongue and the pin prick sensations disappeared. At another time, 10 mg. of pyridoxine was given twice daily for four months. This did not change the angular cheilosis, although the patient described a sensation of well-being which was not present before pyridoxine was administered.

It seems significant that even though, on two separate occasions, she received more than adequate dosage of riboflavin, the angular cheilosis persisted. It is of additional interest that administration of neither niacin nor pyridoxine had any effect on angular cheilosis in this case. We believe that, even though riboflavin deficiency was one of the basic causes, the restoration of the vertical dimension with well-functioning, correctly fitted dentures would be the only means of bringing about complete healing of the angular cheilosis.

Comment

Perhaps the most important finding in this study is the importance of restoring the normal vertical dimension and dental function, which were lost when the

teeth were extracted. This can be accomplished only by the construction of well-fitting complete dentures—dentures which will restore the normal vertical dimension. It is interesting to note that only twenty of the 160 patients studied were found to have dentures approaching this standard. The 140 other patients all showed a decrease in vertical dimension, angular cheilosis and alimentary tract complaints in surprisingly similar incidence. This indicates that loss of teeth with subsequent failure to restore dental function contributes directly to the establishment and maintenance of nutritional deficiency disease. It also seems logical to assume that inadequate trituration of food because dentures are ill-fitting also aggravates gastric disturbance.

The few dentures that restored dental function lost by extraction had been worn for only one or two years, while many of those that failed to restore dental function had been worn for ten to twenty-five years. This emphasizes the importance of periodic mouth examination in complete denture patients to detect any settling or malrelation of the dentures to the ridges or to each other. When settling is evident, the denture should be rebased or remade as soon as possible.

Summary

1. Pyorrhea was the chief cause of extraction in the 160 cases studied. One hundred and five patients lost their teeth because of pyorrhea, twenty-nine because of dental caries, twenty-one because of hypersensitivity of the teeth or because their physician recommended it and five because of periapical infection.

2. In this group of 160 malnourished, edentulous patients, seventy-four were without the upper or lower denture or both. Vertical dimension was diminished in sixty-six other patients who had both dentures. Only twenty patients were wearing dentures restoring the vertical dimension.

3. A similarly high incidence of angular cheilosis (120 cases) and alimentary tract complaints (112) was noted in the 160 cases studied. These conditions were much more severe in the patients in whom the vertical dimension was decreased and dental function was inadequate.

4. A decrease in vertical dimension, infectious processes and hypovitaminosis all seem important in the etiology of angular cheilosis. Correction of all three etiologic factors is recommended to secure optimum therapeutic results. The relative importance of each factor varies in individual cases.

5. Inadequate dental function contributed greatly to the establishment and maintenance of nutritional deficiency disease in the 160 edentulous patients studied.

THE BIOCHEMISTRY OF ORAL CALCULUS.

I. CONDITIONS PREDISPOSING TO ORAL CALCULUS DEPOSITION*

Gustav William Rapp, Ph.D., Chicago, Ill.

The biochemical mechanisms that operate to deposit oral† calculus from the saliva onto the tooth surfaces within the oral cavity are, in general, still obscure despite the considerable number of data that have accumulated concerning this complex problem.

Most reported activities in this field utilized one or the other of two distinct methods of attack: (a) experimental production of concretions and (b) correlation of salivary composition with the tendency of the saliva to deposit calculus.

The experimental work dealing with production of oral calculus has necessarily been performed *in vitro*. This is unfortunate since, in many instances, reactions occurring *in vivo* are duplicated only with great difficulty *in vitro*. Certainly the quantitative, and in many instances even the qualitative, aspects of biochemical reactions are disturbed by such a change. Various attempts have been made to relate calculus formation with changes in carbon dioxide content, salivary colloids, bacterial action and phosphatase activity in human saliva. These are reported in the literature and have been ably reviewed and criticized by Rosebury and Karshan[1] as well as Bibby,[2] further discussion here thus becoming unnecessary.

Reports concerning the second line of attack, that is attempting to find significant variations in salivary constituents which might be related to the predisposition to dental calculus, are not so numerous. Tenenbaum and Karshan[3] compared the values for concentrations of calcium, phosphate and total protein and of the pH of the saliva of a group of calculus-free individuals with those from the saliva of persons having extensive calculus deposits. Their results indicate that the calcium content of the saliva from the calculus-positive group was higher than that of the saliva from the calculus-free group. The phosphate content of the two groups showed a similar tendency, while the differences in total protein and pH values were not appreciably greater.

An analysis of salivary calculus[4] shows it to be composed chiefly of calcium and phosphate salts, with some carbonate and admixed organic matter. These constituents are all found normally in human saliva. In the simplest terms, then, deposition of oral calculus can be regarded as a separation of salivary components, mainly calcium and phosphate, from the solution. Whether these components separate from solution is deter-

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†The term "oral" calculus is employed since in these communications no difference in significance is implied between "salivary" calculus and "serumal" calculus.

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mined largely by two opposing factors: (a) those tending to keep the salts in solution, among them being hydrogen ions, proteins and amino acids, and (b) those tending to force the salts from solution, some of which are an increased hydroxyl ion concentration, increase in calcium, phosphate and ammonium ions, loss of salivary proteins and loss of bicarbonate ions through the loss of carbon dioxide.

In view of the fact that in blood or saliva, the concentrations of calcium, phosphate, hydrogen, bicarbonate and protein ions are interrelated and dependent on one another, they should not be considered separately, but as part of a complex equilibrium. As a matter of fact, we can simplify the huge complexity of calculus deposition somewhat if we consider the elements of the saliva as in equilibrium, with a dynamic interplay of calcium ions, phosphate ions, hydrogen and hydroxyl ions, bicarbonate ions and proteins, either ionized or nonionized. We are interested here only in those ions dissolved in saliva which can contribute to the precipitation of insoluble substances from the saliva.

The equilibrium between calcium, phosphate and hydrogen ions, in contact with undissolved calcium-phosphate salts, of human saliva has been studied for another purpose, by Fosdick and Starke.[5] Of importance for the present problem is the observation that the calcium-phosphate-hydrogen ion interrelationship is such that, at a given calcium and phosphate ion concentration, there is a corresponding pH value below which the solid phase will go into solution, but above which it will not. This particular pH value is referred to as the critical pH. Below this critical pH value, the solvent is undersaturated with respect to calcium and phosphate ions and, in order to restore equilibrium, a portion of the solid phase must go into solution to supply more calcium and phosphate ions. But, above this pH, the solvent is oversaturated with respect to these two ions; and if true equilibrium is to be reestablished, a portion of the calcium and phosphate ions must be removed from the solution.

We can apply this concept of the criti-

Table 1.—Analysis of Calculus-Positive Saliva

1 Case	2 Calcium Mm/l	3 Phosphate Mm/l	4 pH	5 S.P./F^2 ($\times 10^{15}$)	6 Critical pH	7 Difference (4-6)
C1	1.69	3.78	7.42	69.0	6.20	1.22
C2	1.32	4.07	6.97	38.1	6.33	0.64
C3	1.52	3.69	7.30	47.8	6.26	1.01
C4	1.82	5.46	7.10	180.0	5.98	1.12
C5	1.32	4.46	7.57	45.7	6.30	1.27
C6	1.94	4.75	7.37	165.0	6.01	1.64
C7	1.69	4.46	7.60	96.0	6.16	1.44
C8	1.69	4.50	6.83	97.7	6.15	0.68
C9	1.57	4.44	7.52	76.3	6.20	1.32
C10	1.64	3.32	7.60	48.6	6.32	1.28
C11	1.57	3.75	7.62	54.4	6.25	1.37
C12	1.87	5.92	7.22	229.0	5.90	1.30
Average	1.64	4.39	7.34*		6.17*	1.17

*Average of corresponding H ion concentrations, reconverted into pH units.

5. Fosdick, L. S., and Starke, A. C., Jr.: J. D. Res. 18:417, October 1939.

cal pH to the problem of oral calculus by noting that, at a given concentration of calcium and phosphate ions in the saliva, there is a given narrow pH range in which true solution equilibrium exists. If the pH is raised above this value, so that the medium becomes more alkaline, salivary calcium-phosphate salts may be precipitated from the solution. The greater the difference between this critical pH and the actual pH of the saliva, the greater the tendency of insoluble salts to separate from the solution. It must be remembered that this critical pH is dependent on both the calcium and the phosphate ions in solution and at the same time. It is therefore possible for saliva specimens of greatly different calcium and phosphate concentrations to have the same critical pH.

The work herein reported dealt with two fundamental questions:

1. Is the actual pH of secreted saliva the same as, higher than or lower than the critical pH for the salivary calcium and phosphate concentration of that particular saliva?

2. Is the critical pH for calculus-positive saliva further removed from the actual pH than is the case for calculus-free saliva? The answer to this question will also indicate whether calculus-positive saliva has a greater precipitating tendency than calculus-free saliva.

Experimental Data

Ten persons who had little or no calculus deposited on the teeth for at least a year were considered calculus free. Twelve persons with a marked deposit were considered to have calculus-positive saliva.

Saliva flow was increased by chewing of paraffin. The saliva was collected under oil in large test tubes, and immersed in ice water to minimize the escape of carbon dioxide and enzymatic catalysis. Hydrogen-ion determinations were made with a glass electrode and a Coleman potentiometer. Calcium analyses were made by the method of Clark and Collip[6] and phosphate was estimated by the Fiske and Subbarow method[7] adapted to a Coleman universal spectrophotometer.

Table 2.—Analysis of Calculus-Free Saliva

1 Case	2 Calcium Mm/l	3 Phosphate Mm/l	4 pH	5 S.P./F^2 ($\times 10^{15}$)	6 Critical pH	7 Difference (4-6)
N1	1.12	2.97	6.93	12.4	6.65	0.28
N2	1.12	4.24	7.28	25.3	6.40	0.88
N3	1.12	3.77	7.00	20.0	6.40	0.60
N4	1.37	4.24	7.43	46.2	6.30	1.10
N5	1.62	3.00	7.37	38.2	6.32	1.05
N6	1.42	4.32	7.17	53.4	6.25	0.92
N7	1.35	4.45	7.30	48.7	6.38	0.92
N8	1.10	2.85	6.66	10.8	6.63	0.03
N9	0.93	3.07	6.80	17.6	6.70	0.10
N10	1.10	4.35	7.13	25.2	6.40	0.73
Average	1.23	3.72	7.10*		6.45*	0.65

*Average of corresponding H ion concentration, reconverted into pH units.

6. Clark, E. P., and Collip, J. B.: J. Biol. Chem. 63:461, March 1925.

7. Fiske, C. H., and Subbarow, Y.: J. Biol. Chem. 66:375, December 1925.

Results and Calculations

The calculations of the critical pH values were made by the method outlined by Fosdick and Starke.[5] The values for calcium and phosphate analyses were incorporated in the equation:

$$(Ca^{++})^3 \times (P \times F)^2 = S.P.$$

where (Ca^{++}) and (P) indicate the appropriate molar concentrations of calcium and phosphate respectively and (F) represents the fractional portion of the phosphate ionized as phosphate ions. S. P. is the apparent solubility product under those conditions. For simplicity, the equation was resolved into:

$$(Ca^{++})^3 \times (P)^2 = \frac{S.P.}{F^2}$$

This transformation facilitates the determination of the critical pH value from an enlarged version of the graph given by Fosdick and Starke.[5] The results are presented in Tables 1 and 2.

Comment

An inspection of the tables shows clearly that the saliva from both groups of persons studied have calcium and phosphate concentrations of such values that the critical pH lies below the experimentally measured pH. Since no visible amounts of precipitate were evident, it appears that a small portion of the calcium and phosphate is held in solution by the presence of bicarbonates or proteins.

It can be seen that, in the case of the calculus positive group, the higher calcium and phosphate content of the saliva over that of the calculus-free group made possible a much lower critical pH value; that is, the composition of calculus-positive saliva is conducive to a greater precipitation tendency than that of calculus-free saliva, since the difference between the critical pH and the actual pH is much greater for the former group than for the latter. These results would tend to indicate that calculus-positive saliva requires only a little alkalinization for precipitation of insoluble salts out of the solution, as compared with saliva from the calculus-free group. It showed, moreover, that, without further alkalinization, the former saliva is more oversaturated with respect to calcium and phosphate ions at their usual pH values in the mouth than is the latter. This oversaturation is closely connected with the amount of calcium secreted and excreted via the salivary glands. The excretion of calcium is determined largely by the calcium intake, body requirements and the "calcium threshold"[8] of the salivary glands.

Summary

1. Calculus-free saliva and calculus-positive saliva were analyzed for calcium, phosphate and hydrogen-ion concentration.

2. These values were employed for the determination of the critical pH of that saliva, with respect to calcium and phosphate.

3. It was found that all of the saliva had an actual pH which was higher than the calculated critical pH.

4. It was found that persons from the calculus-positive group had saliva with a critical pH lower than that of saliva from calculus-free persons.

5. It was found that there is a greater difference between the actual pH and the critical pH in calculus-positive saliva than in calculus-free saliva.

6. It is suggested that the variation in critical pH values between the two groups examined is largely due to differences in calcium secretion and excretion.

7. It is suggested that the considerable difference between the critical pH and actual pH of the calculus-positive saliva makes this saliva rather highly oversaturated with respect to calcium and phos-

8. Rapp, G. W., to be published.

phate so that these elements may easily separate from the solution and be deposited upon the teeth in the form clinically recognized as oral calculus.

8. It is suggested that saliva with such a considerable difference in the critical pH and the actual pH requires only a little additional alkalinization to cause precipitation of large amounts of insoluble calcium phosphate salts.

BLOOD STUDIES IN PERIODONTOCLASIA*

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A number of blood studies have been made in an effort to throw light on the etiology of periodontoclasia. Several investigators have reported high values in different percentages of their cases for calcium,[1-7] cholesterol,[1, 2, 4, 8] uric acid,[3, 5, 8, 9] sugar [1, 2, 4, 5, 6] and local phosphatase.[10] The last refers to the phosphatase in gingival blood. Low values have been reported for vitamin C[11-14] and carbon-dioxide combining power.[4, 15] Other workers have failed to confirm the findings for calcium,[16] uric acid[8] and sugar,[3, 17] a fact that may be due, in part, to lack of uniformity in the selection of cases.

In the present study, blood was analyzed in seventy patients, 12 to 61 years of age, with advanced periodontoclasia; and in twenty-two persons, 17 to 60 years of age, who were free from this condition. In the periodontoclasia group, there were only two persons under the age of 20. Fourteen of the fifteen patients in this group between the ages of 12 and 33 years were females; whereas, after 33 years of age, the patients were almost equally divided between the two sexes. Since virtually all patients suitable for our investigation were sent to us as they appeared in the clinic, this age distribution suggests that the disease, when it occurs at an early age, is most prevalent among females.

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*Read at the general meeting of the International Association for Dental Research, Chicago, Ill., March 18, 1944.

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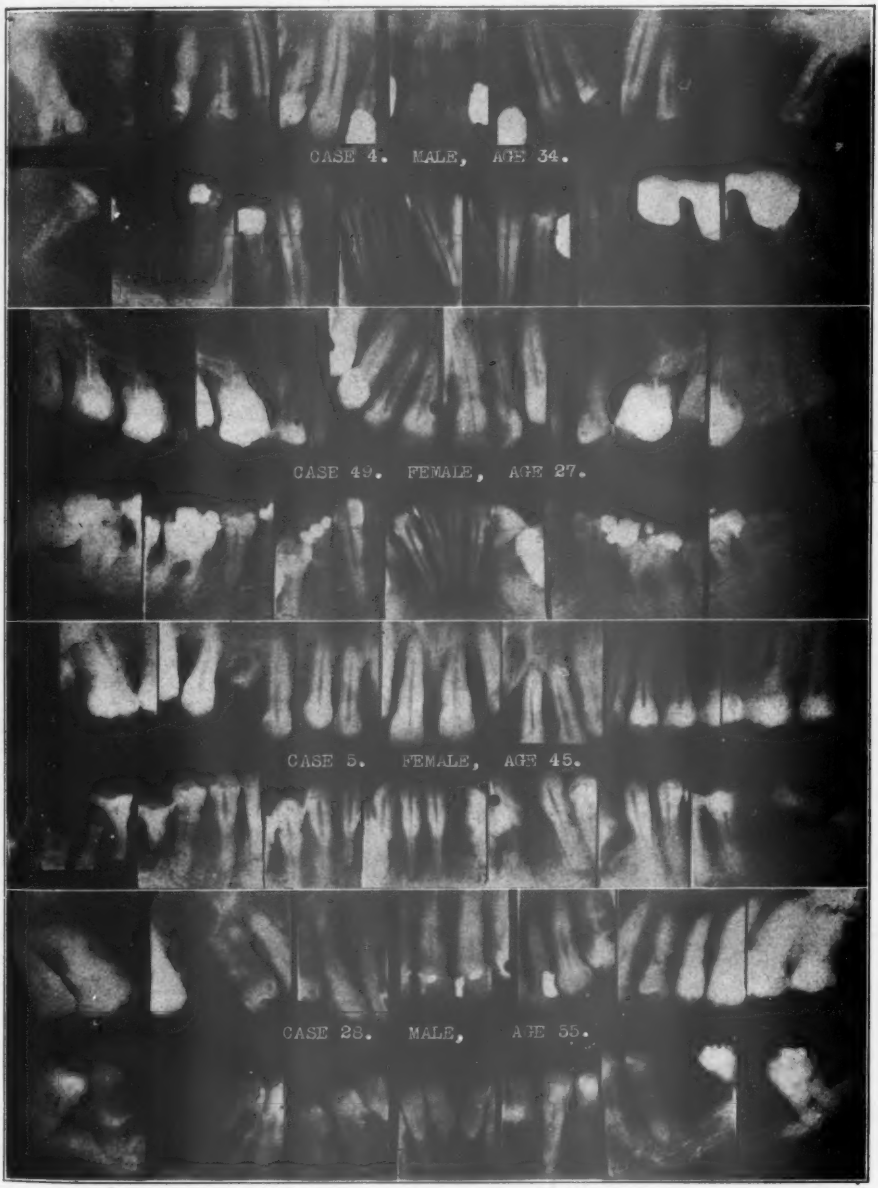

Fig. 1.—Four cases showing varying degrees of both supragingival and subgingival deposits. Cases 4 and 49 had normal blood values. In Case 5, there was a large amount of phosphatase, with little calcium and vitamin C. In Case 28, there was a large amount of calcium and phosphatase.

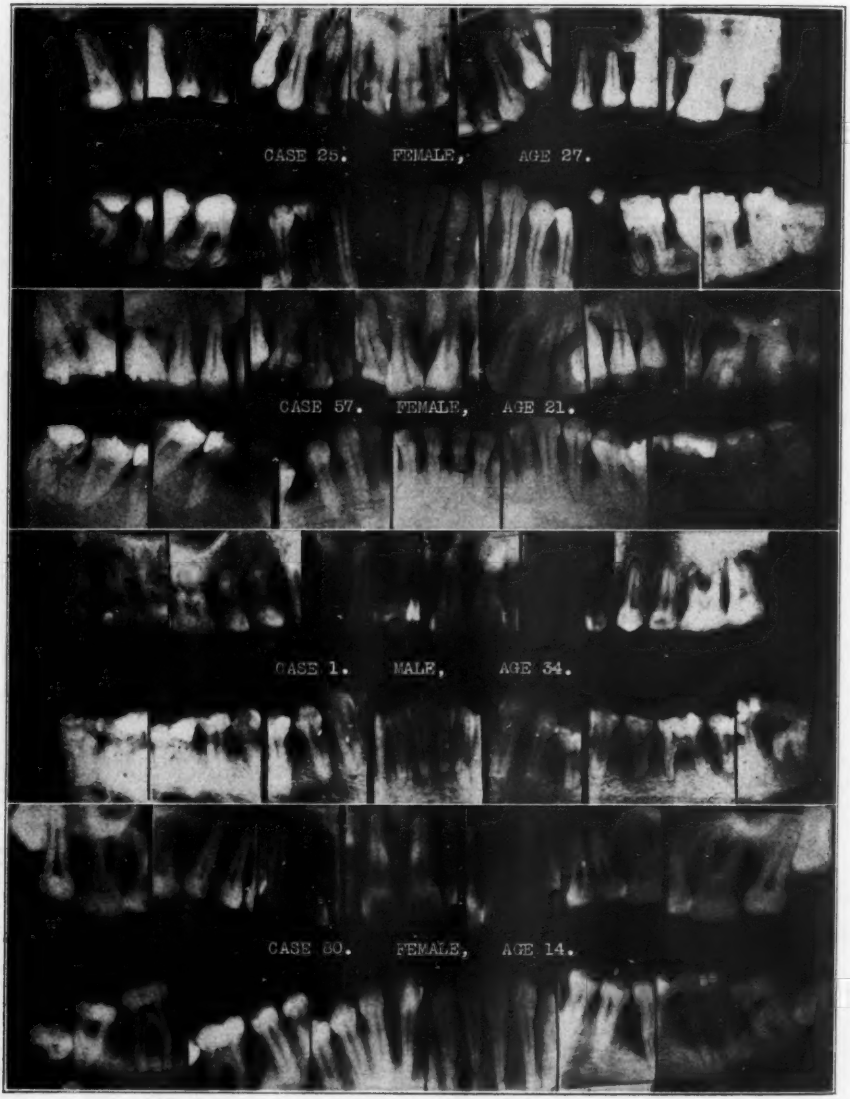

Fig. 2.—Four cases showing slight or no supragingival or subgingival deposits. Cases 25 and 57 had normal blood values. In Case 1, there was a large amount of cholesterol. In Case 80, there was a large amount of phosphatase and cholesterol, with little vitamin C.

Determinations were made on fasting blood, drawn from the most prominent vein at the bend of the elbow, for total calcium, inorganic phosphate, phosphatase, protein, sugar, uric acid, carbon-dioxide combining power, total cholesterol, vitamin C and red-cell sedimentation rate. In the periodontoclasia

patients, analyses were made before all the remaining teeth—at least twelve—were extracted. Fifty-seven persons out of the seventy had varying degrees of both supragingival and subgingival deposits, while thirteen had either very light or no supragingival or subgingival deposits. Roentgenograms of typical cases are shown in Figures 1 and 2.

Methods for Blood Analysis

The methods for blood analysis were as follows:

1. Calcium. The Kramer and Tisdall[18] method as modified by Clark and Collip[19] was followed except that the precipitate of calcium oxalate was washed twice with ammonium hydroxide; the second time without disturbing the precipitate, but with thorough washing of the wall of the centrifuge tube.
2. Inorganic phosphate and phosphatase.[20, 21]
3. Protein.[22]
4. Sugar.[23]
5. Uric acid.[24, 25]
6. Carbon-dioxide combining power.[26]
7. Cholesterol.[27]
8. Vitamin C.[28]

Four cubic centimeters of the protein-free supernatant fluid was titrated with a solution of dichlorophenolindolphenol having half the concentration called for in the original method.

9. Sedimentation rate.[29]

Results

Except for the sedimentation rate, sixteen of the seventy patients who were in the periodontoclasia group gave completely normal blood values; whereas, in the remaining fifty-four cases, deviations from the normal ranges were found in one or more respects. In general, the deviations were slight. On the other hand, nineteen of the twenty-two control cases gave completely normal values, the single deviation in the three remaining patients being low vitamin C values.

The results are given in Table 1. The normal ranges taken from the literature, as given in this table, hold for all constituents except cholesterol. According to Sperry,[30] normal blood cholesterol appears to be maintained at a constitutional level that is characteristic for each individual. When disease alters the blood cholesterol, it may remain within normal limits even though departing significantly from its value during health. This makes it difficult to interpret individual cholesterol values. We believe that the results for cholesterol in the periodontoclasia group could be best evaluated by comparing them directly with those in the control group.

It is clear from these data that, with the exception of vitamin C, the ranges of values in the control group fall within normal ranges as reported in the literature. Three vitamin C values out of twenty-two were below 0.7 mg. per hundred cubic centimeters. On the other hand, many deviations from the normal were found in the periodontoclasia

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group. For calcium, there were eleven such values, nine above and two below the normal range. Two of the four inorganic phosphate and thirteen of the nineteen phosphatase values were above the upper limit of the normal ranges. For cholesterol, out of thirteen deviations, ten were above the highest figure for the control group. Twenty-three of the vitamin C values were low. Nineteen gingival deposits. All of these patients were between the ages of 12 and 38 years, and the group of thirteen included eleven females. Eight of the thirteen cases gave one or more abnormal blood values, which were distributed among the same constituents for which deviations were found in the calculus group. In the latter group, forty-six of fifty-seven cases gave one or more deviations

Table 1.—Blood Constituent Values in Control and Periodontoclasia Group

Blood Constituent	Normal Range (from Literature)	Range of Values Found in		Number of Cases in Periodontoclasia Group with Values Outside Normal Range		Percentage of Cases in Periodontoclasia Group with Values Outside Normal Range
		Control Group (22 Cases)	Periodontoclasia Group (70 Cases)	Above	Below	
Calcium, mg./100 cc. serum	9.0-11.4	9.6-11.0	8.8-15.8	8	2	15
Inorganic phosphate, mg./100 cc. serum	2.2-4.0	2.2-3.7	1.8-4.7	2	2	6
Phosphatase, Bodansky units/100 cc. serum	1.5-4.0	1.5-4.0	1.1-7.5	13	6	28
Protein, gm./100 cc. serum	5.8-8.4	5.8-6.9	5.8-8.2	0	0	0
Cholesterol, mg./100 cc. plasma		100-260	84-384	10	3	19
CO_2 combining power, cc./100 cc. plasma	55-75		55-71	0	0	0
Vitamin C, mg./100 cc. plasma	0.7-2.4	0.5-1.6	0.4-2.1	0	23	33
Sugar, mg./100 cc. whole blood	70-94	71-92	70-127	19	0	28
Uric acid, mg./100 cc. whole blood	1.5-4.0	2.1-4.0	1.7-4.7	2	0	3

sugar values were above the upper limit of the normal range. For uric acid, two cases gave high values. To summarize: 15 per cent of the calcium, 28 per cent of the phosphatase, 19 per cent of the cholesterol, 33 per cent of the vitamin C and 28 per cent of the sugar values were outside the normal ranges.

It has already been mentioned that thirteen patients in the periodontoclasia group had either very slight or no supra- from the normal. There was thus no clear distinction so far as the blood analyses are concerned between the group with moderate or heavy calculus and that with slight or no deposits.

In twenty-one cases that gave abnormal values, analyses were repeated after all the teeth had been extracted, the infection had cleared up and the healing of the alveolar bone and gingiva had taken place. Twelve of the patients con-

tinued to give abnormal values in the repeat analysis.

The results regarding red-cell sedimentation rate are given in Table 2. Only two control cases out of twenty-four, or 8 per cent, gave values above normal; whereas, in the periodontoclasia group, twenty-seven out of fifty-one cases tested, or 53 per cent, showed a high rate. The percentage of deviations in our control group does not differ appreciably from that previously reported by Haskins and his collaborators.[30]

Table 2.—Cell Sedimentation Rate

	Number of Cases	Number of Cases Above Normal	Percentage of Cases Above Normal
Control group	24	2	8
Periodontoclasia group	51	27	53
Normal group (from literature)	295	15	5

Conclusions

Fifty-five out of seventy patients with advanced periodontoclasia showed one or more deviations from normal blood ranges. These deviations were, in general, slight, including calcium, phosphatase, sugar, cholesterol, and vitamin C content. No differences were found between the group from 12 to 33 years (predominantly female) and that between 34 and 60 years. No clear distinction was found between the group with moderate or heavy calculus and that with slight or no deposits. In the control group of twenty-two persons who were free from periodontoclasia, the ranges of values were normal with the exception of three low vitamin C values. These results suggest that some systemic condition was one of the contributing factors in periodontoclasia in many of the subjects studied. This view is strengthened by the results obtained when the blood was analyzed a second time, after the teeth were extracted, since of twenty-one cases that showed deviations from the normal in the first analysis, twelve continued to give abnormal values in the repeat analysis.

The red-cell sedimentation rate, which is an indication of infection, inflammation and malignancy, was high in about one-half of the periodontoclasia cases tested.

THE CASTING PROCESS

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In the casting process, the investment of the wax pattern is an important step. Attention to this operation will do much toward assuring a pattern chamber from which a casting may be obtained and which is smooth and is free from nodules and will reproduce the fine markings in the original wax model. This problem has received a great deal of attention from dentists and other investigators ever since the casting process was first given to the profession. R. L. Coleman,[2] and later Souder and Paffenbarger,[2] in their study of the physical

1. Coleman, R. L.: Physical Properties of Dental Materials, Gold Alloys and Accessory Materials. Bureau of Standards Research Paper 32, 1928.

properties of dental materials, gave considerable attention to the causes of surface roughness on castings, reaching the conclusion that this roughness was produced in two ways: (1) by water clinging to the pattern and weakening the investment forming the surface of the mold and (2), more important, by the presence of air trapped in the investment and forming bubbles that cling to the wax pattern during the process of investing.

Two methods were suggested to overcome this difficulty, at least partially: (1) careful hand or mechanical spatulation of the mixture of water and investment to eliminate air bubbles as far as possible and great care in applying the mixture to the pattern by brushing and painting; and (2) mixing of the investment in a vacuum, for which Dr. Coleman devised an experimental apparatus. Mixing of the investment in a vacuum was found to give a mold surface exceedingly smooth and dense and entirely free from air bubbles; but, apparently, the apparatus was thought too complicated for use in the average dental office.

I wish to present to the profession a new method for investing the wax pattern in a vacuum. By this method, the water and investment material are mixed in the ordinary manner and then placed in a vacuum chamber from which all air has been removed. The investment of the pattern is completed in the vacuum chamber in the total absence of air. There is thus produced a mold, having an exceedingly smooth and dense surface, from which a casting may be secured that is entirely free from nodules caused by air contained in the investment mixture or trapped during the process of investing the pattern. The resulting castings are not only smooth, but also reproduce the finest details in the wax pattern.

2. Souder, Wilmer, and Paffenbarger, G. C.: Physical Properties of Dental Materials, Circular C 433, 1942.

The idea of investing wax patterns in a vacuum is not altogether new. E. R. Granger,[3] among others, devised apparatus for this purpose and published a description of his method in an article on casting platinum. The process about to be described depends on an entirely different principle. It is not original with me, having been discovered by C. H. Brace, of the General Refineries, Minneapolis. Mr. Brace devised his method for the manufacturing jeweler, to be used in making multiple castings for rings and other jewelry. Thinking that his method might be of use to dentists in their work, he experimented in that field also and developed an apparatus for dental use. I had an opportunity to spend some time with Mr. Brace in working out several of the special problems of adapting the process to the mak-

Fig. 1.—Bell-jar (*A*), with rubber collar (*B*), in position on ground glass slab (*C*), with sprue base and rings in place in readiness to exhaust air.

3. Granger, E. R.: Platinum-Iridium Casting, New Concept of Casting Process. J.A.D.A., 27:1718, November 1940.

Fig. 2.—Filter pump with coupling (*A*), which fits any water faucet, and hose leading to vacuum chamber.

ing of dental castings. I am indebted to Mr. Brace and other members of the research staff at General Refineries for the demonstration of the process and for the free use of their facilities in experimenting with it. The results obtained were so gratifying that I immediately adopted the process for investing wax patterns in my office and have been using it routinely for three or four years. A number of men to whom I have demonstrated the method report equally satisfactory results. It is as a method that has been tried and proved in practice that I am offering it here.

Briefly, the process consists in placing the wax pattern, mounted on a sprue base and surrounded by a casting ring filled with freshly mixed investment, in a vacuum chamber and exhausting the air. After all air has been removed from the investment material in the vacuum chamber, the air is again admitted and the investment material, now completely freed from all trapped and dissolved air, is forced down into the casting ring and against the wax pattern. By the elimination of all air, the particles of investment material are brought into the closest possible contact with the wax pattern and with each other. The resulting mold, after the investment has set and the wax has been eliminated, presents an extremely smooth dense surface and the castings obtained are uniformly smooth and reproduce the finest markings on the wax pattern.

The apparatus employed, which is fully illustrated in the photographs accom-

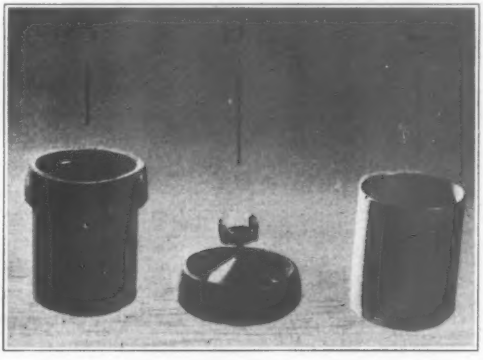

Fig. 3.—Casting ring (*A*), with rubber collar in place; rubber sprue base with pattern in position (*B*), and second casting ring that fits onto first one (*C*).

panying this article, consists first of a vacuum chamber made of glass or other transparent material so that the process may be observed, and a pump for exhausting the air. As originally designed, the vacuum chamber was a bell-jar, provided with a T fitting at the top, having a connection with the air pump by means of a noncollapsible rubber tube and a stopcock for admitting air. The bottom of the bell-jar is provided with a soft rubber collar and rests on a piece of plate glass, ground on one side, so that when the jar with its rubber collar is placed on the ground surface of the slab, an air tight joint is formed. As the air is exhausted from the bell-jar, the pressure of the air on the outside forces the bell-jar against the slab so tightly as to exclude all air.

The pump for exhausting the air is a filter type or air pump of the water jet type such as is sold by makers of chemical apparatus. It operates by water pressure and has a rubber connection to fit any cold water faucet. It is necessary to have a water pressure of about 45 pounds per square inch to operate the pump efficiently. At this pressure, the pump will produce a vacuum of 5 or 6 mm. of mercury, which is sufficient for the purpose. Other types of air pumps are available and may be substituted when water pressure is not sufficient to operate the filter pump just described. This type of pump is inexpensive and will last indefinitely without requiring any attention.

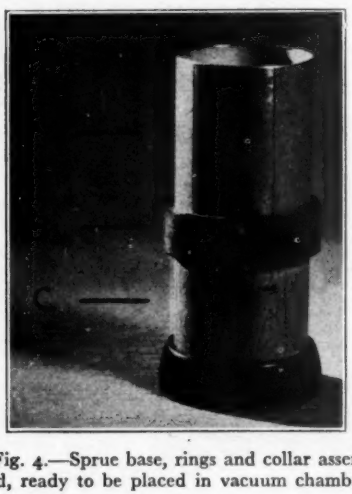

Fig. 4.—Sprue base, rings and collar assembled, ready to be placed in vacuum chamber.

The only other special requirements are a sprue base, preferably of rubber, into which the sprue pin holding the pattern will fit tightly and over which the casting ring will fit snugly, so that neither the ring nor the pattern will be displaced during the investment process. Two casting rings are needed. One fits over the sprue base in the usual manner and the other is attached to the top of the first one by means of a rubber collar so as to double the length of the casting ring during the process of investment.

The method of using the above-described apparatus for investing a wax pattern is as follows:

The wax pattern is sprued in the usual manner and mounted on the sprue base, into which it fits tightly. The casting ring, which fits the base snugly, is then placed in position and the second ring is placed on top of the first one and is held in place by the rubber collar so that the height of the casting ring is about doubled. The manner of assembling is shown in Figure 4.

The investment material and water are then weighed or measured, placed in the clean plaster bowl and spatulated until the water and the powder are thoroughly mixed. No special care is needed to avoid mixing in air at this point. This mixture of investment material is then poured into the top of the casting ring and allowed to flow down over the wax pattern. The amount should be sufficient to fill the first ring and extend up a short distance into the second ring. The entire assemblage is then placed on

the glass slab and the bell-jar placed in position over it. The stopcock shown at D in Figure 1 is then closed. The filter pump, which is connected with the bell-jar by a rubber hose, is placed in position on the water faucet and the valve fully opened.

In a few seconds, the investment material will be seen to rise to the top of the second ring and flow over the top slightly, giving off numerous bubbles. The bubbling proceeds violently for a few seconds and then begins to subside, and the investment material will be seen to sag slightly and tend to settle back into the casting ring.

In a few seconds more, the stopcock may be opened and the air allowed to enter the vacuum chamber. The bubbling ceases instantly and the inrushing air forces the investment material down into the casting ring and causes it to adapt itself closely to the wax pattern. The water may now be shut off and the bell-jar removed from the slab. The extension ring with its rubber collar is then removed from the casting ring and the investment in the first ring leveled off with a spatula. This completes the investment of the wax pattern. The entire process takes from two to three minutes.

It will be seen that the sprue pin, sprue base and casting ring must fit together snugly so that they will not be displaced as the investment boils up in the ring. The function of the second ring, which is placed over the regular casting ring, is to confine the investment material so that too much will not flow over the top of the ring, leaving insufficient investment to fully cover the wax pattern.

I have modified the original apparatus somewhat in order to make its use in the small space available in the usual dental office more convenient. A pint fruit jar with a screw cover is substituted for the bell-jar and the necessary connections

Fig. 5.—Apparatus as modified by author. Sprue base with casting ring and radiator hose extension in position are shown at *A*. The fruit jar vacuum chamber is shown at *D* with top provided with T connection having a stop-cock at *B* and connection for hose to air pump at *C*.

are soldered to the metal cover, which is reinforced by soldering a disk of brass or copper in place of the glass disk usually found there. The cover is made to fit the jar tightly by means of the rubber washer supplied for the purpose. The smaller chamber speeds up the process as there is less air to be exhausted. A short length of automobile radiator hose is used to slip over the casting ring to increase its length temporarily, instead of the metal ring and rubber collar. This still farther simplifies the apparatus.

The principle on which the process depends is the well-known physical law that the boiling point of water, or the temperature at which it turns to vapor, is lowered as the atmospheric pressure is reduced.

Water boils at 100 C., or 212 F., at the usual pressure of 760 mm. of mercury. At

Fig. 6.—Process in operation in vacuum chamber. The investment is bubbling over the top of the ring.

a pressure of 6.5 mm., such as is maintained in the vacuum chamber described above, the boiling or vapor point is 5 C. When the mixture of water and investment is subjected to this low pressure, the water in the investment begins to vaporize rapidly. The bubbles of water vapor rise to the top, carrying the particles of investment along with them. While this boiling is taking place, all the air that may have been trapped in the investment mixture, together with any air dissolved in the water, is freed and carried away by the pump. This boiling of the investment material in the casting ring is a key to the success of the process. The boiling is necessary in order to free the air bubbles throughout the mass of investment material and allow them to rise to the top and escape. When the stopcock is opened and the air again admitted to the vacuum chamber, the investment material, now entirely free of air, is forced against the pattern. The wax pattern is now completely surrounded by a ring full of investment material that is absolutely free of air. When this material sets and the wax is burned out, there results a mold or pattern chamber with a dense smooth surface into which the gold is cast.

Two principal advantages in the use of this process may be mentioned: 1. The castings are smooth and accurate in the reproduction of the finest detail in the wax pattern. The smoothness and absence of all nodules on the cavity surface of the casting saves a great deal of time in seating and finishing the casting. No time need be wasted in removing the annoying nodules, small and large, so often present in castings made by other methods. When desired, time may be saved and equally good results secured by mounting several patterns on one base and investing them in one ring, or by placing several rings filled with investment under the bell-jar and completing the investment simultaneously. 2. Not least in importance, the investing of the wax pattern is no longer a process requiring practice, special training or any manual dexterity for satisfactory results. In the use of this process, the personal equation is practically eliminated and the process of investing wax patterns becomes a simple mechanical procedure requiring no special ability or training and well within the capabilities of the average dental assistant. The results of the novice, after observing one or two demonstrations, can equal those of the expert. As the investment of the wax pattern is a process usually relegated to the assistant or technician, this method should have a special appeal to the busy dentist.

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SURGICAL CONTROL OF HYPERTROPHIC GINGIVITIS

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Treatment of hypertrophic gingivitis has baffled the average dentist, primarily because of a tendency to recurrence, probably due to symptomatic treatment and inadequate attention to predisposing conditions.

According to Thoma,[1] hypertrophic gingivitis is characterized by marked hyperplasia. There is no unanimity of opinion regarding etiologic factors, but in general authorities agree that the disease may be local or systemic. While Thoma[1] describes the main local causes as oral sepsis, malocclusion, mouth breathing and food impaction, Lundquist is more specific in describing the mechanism of "lympathic block"[2] due to oral sepsis and trauma. Both approaches seem logical. Therefore, this article will deal primarily with methods of eliminating these causative conditions and will discuss particularly advanced conditions, giving case illustrations and causes of failure.

Report of a Case

History.—A man, aged 21, complained of soreness and bleeding of the gums of three years' duration. He waked up with the mouth full of blood and a feeling of nausea. He frequently vomited and he was tired and listless in spite of an excessive amount of sleep.

The mouth had been operated on three times, the disease recurring each time in less than three weeks. The patient had received six mapharsen injections intravenously and massive doses of vitamins, especially vitamin C and the factors of B complex under medical supervision, but without noticeable improvement.

The blood, urine and other physical findings were negative. Biopsy report: "The surface epithelium is irregular, hypertrophied, and throughout the corium are varying numbers of round cells and plasma cells in small collections. Diagnosis: Nonspecific inflammation of mucous membrane."

Treatment.—Figures 1 and 2 show the affected areas before and after treatment by resection.

Outcome.—Complete recovery ensued, with a return to good general health, cessation of emesis and a return of energy.

Comment.—Hypertrophic gingivitis, especially those cases which have a previous history of recurrence, must be approached with caution. A search must be made for the cause of previous failure of treatment. In this instance, partially erupted teeth had been overlooked. There had been no correction of trauma and no thorough instruction in interdental stimulation, and the surgical technic had apparently been too conservative, leaving shallow incubation zones.

Discussion

The impression gained from treating many cases of hypertrophic gingivitis is that the conditions which produce these symptoms in a few people apparently do not affect the many who have similar predisposing conditions. As compared with the frequency of other periodontal lesions, this condition is rare. Therefore, it seems only reasonable to believe that persons suffering from these symptoms are sensitized to the toxic effect of protein cleavage or from the bacterial toxins of fusospirochetal disease, which

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1. Thoma, H.: Oral Pathology. St. Louis: C. V. Mosby Co., 1941, p. 701.

2. Lundquist G. R.: Periodontal Involvement and Its Management. J.A.D.A. 32:298, March 1, 1945.

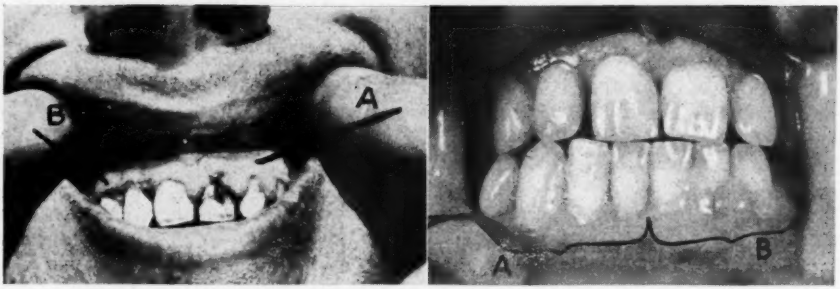

Fig. 1 (Case 1).—Left: Patient who had been operated on three times, the condition recurring each time within three weeks. *A*, condition characteristic of the entire mouth prior to treatment. There is hemorrhage about the upper left central incisor. *B*, tissue after section had been removed for biopsy. This area was treated by resection and was observed for evidence of recurrence for two months, the rest of the mouth serving as a control. All recognized predisposing conditions had been eliminated. Right: Two months after entire mouth was operated on, section *B* remaining as a control (four months since biopsy). During this period, section *B* was treated by conservative methods, which included curettage, balancing of occlusion, thorough brushing and stimulation, and pressure from packs. A, area of resection.

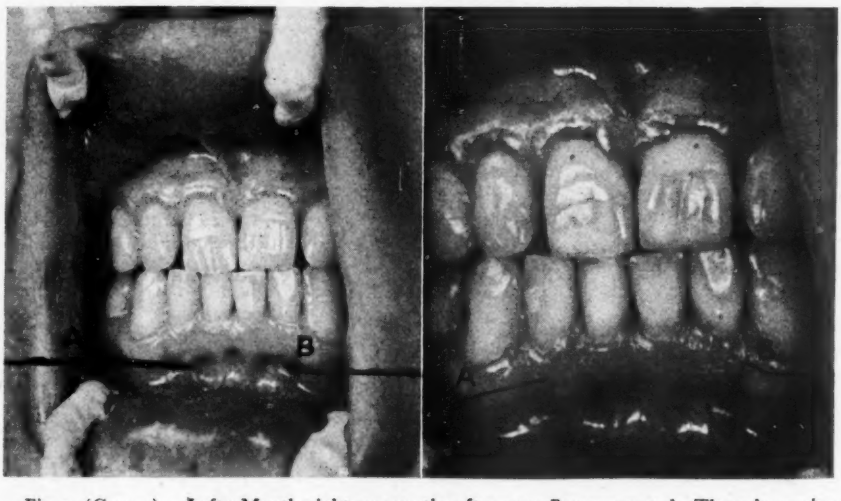

Fig. 2 (Case 1).—Left: Mouth eighteen months after area *B* was resected. There is no sign of recurrence. Right: Close-up of affected area.

apparently is superposed on the lesion, owing to loss of tissue tone. Cases of hypertrophic gingivitis due to blood dyscrasia, ingestion of drugs, avitaminosis and the like are extremely rare. In treating children, it is judicious to avoid surgical measures when possible.

Suggested Order of Treatment

After diagnosis, the following steps are suggested:

1. Balance the bite, if necessary.
2. Give instruction in interdental stimulation with a toothbrush and interdental stimulator for four or more visits, the

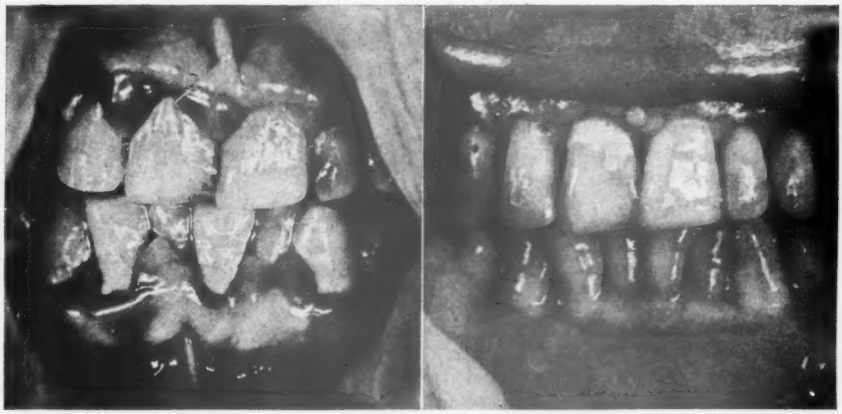

Fig. 3 (Case 2).—Left: Condition before treatment. The medical history was negative. Right: Condition approximately one year after treatment by gum resection. .

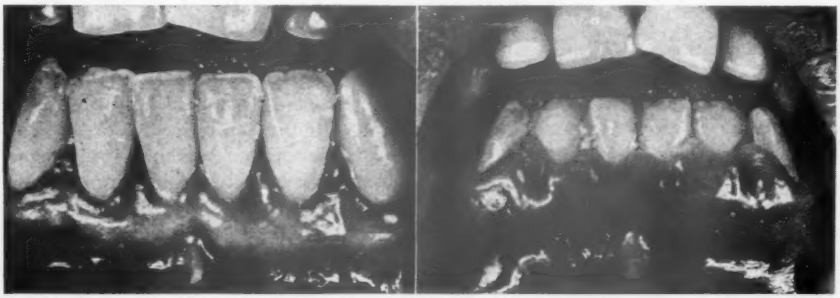

Fig. 4 (Case 3).—Left: Condition before treatment. Right: Condition one month after surgical resection of gums. The results of neglect of home care are evident. This condition cleared up immediately when proper home care was instituted.

patient demonstrating each time. Delay treatment until the patient has shown dexterity and perseverance. Visual instruction on models without continued patient demonstration is of little value.

3. Eliminate local predisposing conditions and refer the patient to a physician for elimination of general conditions.

If the condition is considered beyond treatment by conservative methods such as scaling or by pressure methods as described by Lundquist,[3] surgical measures are prescribed. These are necessary in virtually all advanced cases and those with a history of recurrence or previous prolonged treatment. A small area of tissue is resected, the rest of the mouth being a control. If, after approximately two months, there is no tendency to recurrence, the entire mouth may be operated on with the feeling that recurrence is very unlikely. Even conditions that would ordinarily be treated by so-called conservative methods will not be aggravated by the judicious use of surgery.

Postoperative care, particularly mouth hygiene and stimulation, should be instituted at once when the surgical cement is removed.

3. Lundquist, G. R.: Reference 2, p. 302.

Most Common Reasons for Failure

1. The most common reason for failure is improper or inadequate instruction in home care or lack of patient cooperation, with improper or inadequate adjustment of occlusion, failure to eliminate local and general predisposing conditions and surgical intervention that is too conservative or other methods that do not thoroughly eliminate the pocket, following in order.

Conclusions

1. The ease of operation and the thoroughness and the time saving element involved, as well as the ultimate result, recommend surgery as an indispensable adjunct to the treatment of hypertrophic gingivitis.

2. Any method of treatment will fail if the predisposing conditions are not eliminated and home care is not instituted.

3. As a precaution against recurrence, it is suggested that a small "test section" of the mouth be operated on and observed before complete surgical correction of the mouth is undertaken.

4. Overconservatism, especially failure to get to the "bottom" of the pocket, is the surgical error most commonly leading to recurrence of the disease.

PENICILLIN THERAPY FOR ACUTE PERICORONITIS

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The physiologic effect of high altitude flying has been proved to be an etiologic factor in exacerbations of pathologic conditions of the soft tissues of the mouth.[1-4] Approximately 50 per cent of the pericoronal infections presented for treatment in the oral surgery department at the combat crew training section, MacDill Field, are in flying personnel who have been training at high altitude for the first time.

The first method of treatment in these cases necessitated the grounding of the patient, at least as far as high altitude missions were concerned, until the acute stage of the infection was under control. This meant a loss from training of from three to four days, and, in some instances, grounding of an entire crew if the patient was a key member. Therefore, it was evident early in the study that a method of treating these patients that permitted them to fly, as well as cutting treatment time to a minimum, was of paramount importance.

The empiric method of treatment was the same in all cases of acute pericoronitis. Hot intra-oral irrigation and external application of ice packs were carried out at hourly intervals by the patient. The clinical treatment revolved about the use of various bactericidal solutions and drugs to control the localized infection under the flap of tissue. Still, this meant the grounding of the patient in order that he might follow out the régime of treatment. The length of time required was still several days, no matter what drug was employed.

Laboratory smears and cultures iden-

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1. Girod, C. E., Jr.: Oral Aspects of High Altitude Flights. J.A.D.A. 31:1486, November 1, 1944.

2. Summerville, D. V.: Aviation Dentistry: Effects of High Altitude Flying (Part 1). D. Digest 50:407, September 1944.

3. Medical Safety Division, Office of Flying Safety: Flying and Dentistry. Air Surgeon's Bull. 1:1, December 1944.

4. Strickland, R. L., and Gordon, S. G.: Oral Surgery for A.A.F. Flying Personnel. To be published.

tified the organisms responsible for the infection as falling into the following groups: (1) alpha hemolytic streptococci, (2) alpha streptococci, (3) nonhemolytic streptococci, (4) alpha hemolytic staphylococci, (5) beta hemolytic staphylococci, (6) nonhemolytic staphylococci and (7) Borrelia vincenti.

These bacteria have been found by laboratory test to be penicillin sensitive. It was therefore necessary to devise some means to apply the drug in order to bring the penicillin in contact with the affected parts to overcome the obvious handicap of oral application, which resulted in (1) dilution and carrying away of the penicillin by the saliva and secretions of the mouth and (2) difficulty in maintaining continuous application of the penicillin.

Study of the possibilities of penicillin therapy showed that other workers had used it in dilute solution by injection into the surrounding healthy tissue along with a small amount of procaine. In order to overcome the disadvantages still exhibited by this method, an attempt was made to establish closer contact with the affected tissues. A gauze drain was soaked in penicillin washings (about 200 units per cubic centimeter) and then packed under the flap surrounding the tooth. This did not greatly benefit the patient because the penicillin was too dilute, the saliva soon washed out the drug and application was extremely painful.

A conference with the medical department revealed that it was attempting to perfect a means of applying penicillin in a form that was ideal for our purpose. Major Shannon was searching for a cream base for penicillin to be applied to skin lesions. In conjunction with the hospital pharmacy and laboratory staff, an ointment containing 1,000 units of penicillin per gram in a cholesterized base was developed. This ointment, which satisfied all our requirements, held the penicillin in suspension and released its bactericidal action over a long period of time. It could be readily applied to the affected parts by means of a syringe and needle; it would remain in contact with the tissue and not be diluted by the secretions of the mouth, and it would subject the patient to only a minimum of pain.

The ointment was prepared according to the method of Shannon *et al.* as follows: The penicillin crystals were dissolved in 10 cc. of distilled water with the original ampule as the container. This solution was then incorporated under sterile conditions into 100 gm. of Aquaphor*, a cholesterized water soluble base, in such a manner as to insure equal distribution of the penicillin sodium throughout the base, so that each gram contained approximately 1,000 units of penicillin.[5] As these investigators have shown, this ointment can be stored either at room temperature or in the refrigerator without loss of potency up to as long as six months.

In a short time, a means of carrying the penicillin ointment under the flap of the affected tooth was devised. A large hollow nozzle was soldered to the hub of the Luer-Lok needle and, in turn, fit-

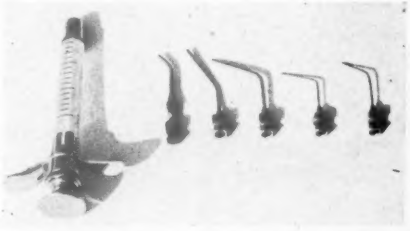

Fig. 1.—Syringe and needles used in application of penicillin ointment. Left to right: first hollow needle employed; second two, and last two and most practical developed.

*Trade name for ointment base of semi-secret composition put out by Duke Laboratories (product not accepted by Council on Dental Therapeutics).

5. Shannon, W. F., et al.: Preparation of Relatively Stable Penicillin Ointment; to be published.

ted to a glass syringe of 3 cc. capacity. (Fig. 1.) The syringe was then filled with penicillin ointment and, after a treatment, the needle was taken off, cleaned of residue and sterilized. As the work progressed, smaller needles were employed to avoid waste of the penicillin and also to expedite carrying the drug to the depth of the pocket. Several 20-gage needles were prepared by cutting off the point and bending the needle to different shapes and angles in order to reach inaccessible parts more readily. The syringe, loaded with penicillin, can be kept at room temperature, in a sterile surgical cabinet, for long periods without loss of potency. (Fig. 1.)

The patients, when first seen at the clinic, generally presented the typical picture of an acute pericoronitis. There was usually trismus due to the pain caused on opening the mouth. Usually, the local tissues were inflamed and tender to palpation. The submaxillary lymph glands were infiltrated, and there was a viscous purulent exudate from the flap over the tooth. The patients had difficulty in the mastication of food and pain on deglutition. There was a general picture of malaise and debility with associated symptoms.

The first step in treatment was to take smears for bacteriologic culture to determine the penieillin sensitivity of the organisms present. The area between the flap and the tooth was then irrigated with a spray of warm water to clean out all superficial débris. Gauze rolls were packed under the tongue and in the buccal fold to isolate the area, and penicillin ointment was carried under the flap with the syringe until it could be seen oozing over the edge of the tissues. All available

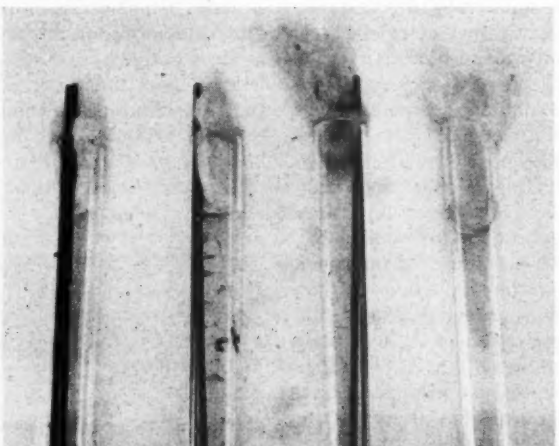

Fig. 2.—Culture tubes used in taking smear from mouth. Right, tube of broth used to transport specimen to laboratory to prevent dehydration.

parts of the pocket were treated in this manner. A sterile gauze pad was laid over the area and the patient held it in position about five minutes. All the packing was then removed and the patient dismissed.

At the second treatment, four hours later, the patients showed a marked improvement. The pain had lessened to such a degree that they could open their mouths with comfort, swallow and masticate food. The general malaise had improved to such an extent that they were cheerful and eager to continue with their flight training. The treatment was repeated and the patients were told to report again in four hours.

Mild cases necessitated only a few treatments, while, in the more severe cases, the penicillin ointment was applied until all the local symptoms had subsided and then the offending tooth was removed and the socket filled with the ointment. The most effective treatment was found to be three applications of the ointment the first day, although some cases yielded results with only one treatment a day. At all times, bacteriologic control was strictly adhered to from the first visit until the patient was discharged. On the whole, the results were excellent from the standpoint of prognosis as well as of comfort to the patient.

Findings

The case data presented in the accompanying table show the results obtained in a new approach to a common patho-

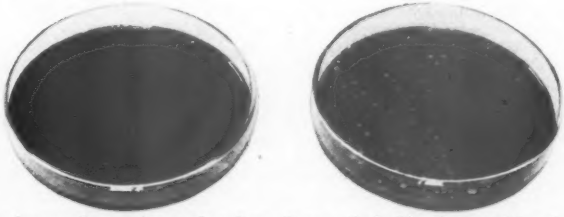

Fig. 3.—Subcultures of organisms taken from Case 1. Left, blood-agar plate showing hemolysis (hemolytic streptococcus and hemolytic staphylococcus). Right, chocolate blood-agar plate with subculture of same bacteria to demonstrate colonies more definitely.

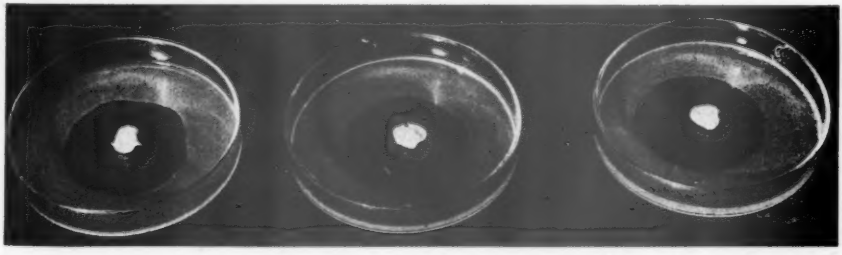

Fig. 4.—Effect of addition of penicillin ointment to subculture of organisms from Case 1. The ointment used at left was 5 months old and had been in constant use. Potency of the penicillin ointment is demonstrated by the clear zone surrounding the drug, while the turbidity of the outer ring shows the growth of the colonies of the bacteria. Center, test plate inoculated with same organisms, but supplied with a freshly made penicillin ointment to test relative potency of older sample of ointment used at left. Right, subculture of same organisms, using larger amount of ointment, demonstrating greater degree of bactericidal effect of larger doses. By weight, the amount of ointment was one and one-half times the original plate, but the photography hides that fact.

Report of Twenty Cases Treated with Penicillin Ointment

Diagnosis	Bacteriologic Report	Treatment with Penicillin	Surgical Treatment	Remarks
1. Acute pericoronitis L-16	Alpha hemolytic streptococcus; beta hemolytic staphylococcus	Three treatments each day for two days	Surgical removal L-16	Condition normal after one post-operative treatment; lost no flying time
2. Chronic pericoronitis L-16	Alpha streptococcus; beta hemolytic staphylococcus	Two treatments on successive days	Surgical removal L-16	History of nine previous flare-ups with failure to respond
3. Chronic pericoronitis R-16	Hemolytic staphylococcus; hemolytic streptococcus	Two treatments the same day	Surgical removal R-16	History of five previous flare-ups; lost no flying time
4. Acute pericoronitis L-16 with cellulitis of cheek	Alpha hemolytic streptococcus; beta hemolytic staphylococcus; nonhemolytic staphylococcus; spirochete of Vincent	Three treatments each day for two days, one treatment third day	Surgical removal L-16	Cellulitis began to subside, after first day; patient flew plane after second day of treatment, yet had no ill effects
5. Acute pericoronitis R-16 with cellulitis of cheek	Alpha hemolytic staphylococcus; alpha streptococcus	One treatment on each of two successive days	Surgical removal R-16	Patient lost no time from flight training
6. Acute pericoronitis R-16	Alpha streptococcus; nonhemolytic staphylococcus	Three treatments first day, two on second day	Surgical removal R-16	Patient lost no time from flight training
7. Acute pericoronitis L-16	No penicillin-resistant organism isolated	One treatment on each of two days	Removal of flap of tissue with electric cautery	Flew five hours at altitude after first treatment and four hours after second with no exacerbation of symptoms
8. Acute pericoronitis R-16	Alpha hemolytic staphylococcus; hemolytic streptococcus	Two treatments on first day	Surgical removal R-16	Flew at 18,000 feet after first treatment
9. Acute pericoronitis R-16 and L-16	No penicillin-resistant organism isolated	One treatment on each of two days, both teeth	Surgical removal R-16 with L-16 one week later	Patient lost no time from flight training
10. Acute pericoronitis manifestation of chronic rarefying osteomyelitis of the mandible	Alpha streptococcus; nonhemolytic staphylococcus	One treatment first day, two on second day	Surgical removal L-15 and L-16 drain with penicillin changed for three days	Patient was in maintenance crew; recovery uneventful; will be under observation for sequestrum formation

11. Acute pericoronitis L-16	Alpha staphylococcus; nonhemolytic staphylococcus	Two treatments on successive days	Surgical removal L-16	Patient lost no time from flight training
12. Acute Vincent's stomatitis and pericoronitis L-16	Spirochete of Vincent; alpha hemolytic streptococcus; beta hemolytic staphylococcus	Stomatitis cleared up in two days, then two treatments third day and one fourth day	Removal L-16 drain with penicillin changed for two days	Patient was pilot and flew throughout treatment
13. Peridontoclasia L-2 with deep pocket formed	No penicillin-resistant organisms isolated	One treatment on each of three days, pus still present; resection of tissue, pus noted two weeks later	Extraction L-2 after failure to respond	Penicillin can exert bactericidal effect, but cannot repair damaged tissue
14. Abscess periapical L-1 with fistula over old socket L-2	No penicillin-resistant organisms isolated	No preoperative treatment with penicillin ointment	Apicoectomy L-1, curetted socket L-2 and fistulous tract; packed with penicillin ointment	Healing was normal and patient lost no time from flight training
15. Acute pericoronitis L-16	No penicillin-resistant organisms isolated	Three treatments first day, two on second day	Removal L-16	Lost no time from flight training
16. Acute pericoronitis R-16	Alpha streptococcus; nonhemolytic streptococcus	One treatment on each of two successive days	Removal R-16	Condition normal after one post-operative treatment
17. Pericoronitis L-15 with chronic rarefaction osseous structures	Alpha staphylococcus; hemolytic streptococcus	One treatment on each of two days	Removal of flap about L-15 with electric cautery	Patient observed for period of four months with no untoward complications
18. Acute pericoronitis R-16	Alpha streptococcus; nonhemolytic staphylococcus	Two treatments first day	Surgical removal R-16	Postoperative treatment revealed condition normal
19. Pericoronitis R-16 with rarefaction osseous structures	No penicillin-resistant organisms isolated	One treatment on each of two days	Removal R-16 drain changed two days	Two days later, condition normal
20. Acute pericoronitis L-16	No penicillin-resistant organisms isolated	Three treatments first two days, one on third day	Surgical removal L-16	Condition normal after one post-operative treatment

logic condition encountered in oral surgery. The patients were all treated with the ointment having 1,000 units of penicillin sodium per cubic centimeter of the Aquaphor* base. Experiments were conducted with several other concentrations, ranging from 400 units to 2,000 units per cubic centimeter, with the maximum effect observed with use of the formula containing 1,000 units per cubic centimeter.

A control study was completed on several selected cases of acute pericoronitis by applying ointment to which no penicillin had been added to the affected tissues. There was no abatement of the condition or subjective symptoms with this method of treatment, this definitely proving that the penicillin was the deciding factor in the cure.

In a study involving penicillin, it is necessary to use laboratory control at all times. The laboratory prepared the solutions and ointments and cooperated by making bacteriologic diagnosis and determining whether the organism was sensitive to penicillin. (Figs. 3 and 4.) The results of this report bear out the findings of Laurence P. Garrod[6] in his study of the laboratory control of penicillin treatment. He states that the great majority of bacterial species found in the mouth are penicillin sensitive, unlike those found in the bowel, where the prevalence is of the resistant species.

The relief of subjective symptoms shortly after treatment with penicillin ointment was instituted was apparent early in the study. It was thought, in some cases, to be a psychosomatic reaction to the fact that the patient was getting the benefits of the "wonder drug." Clinically, when the patient returned for the second treatment, there was marked improvement in general. There was less pain on swallowing and the jaw could be opened without pain. The subjective symptoms rapidly disappeared as the treatment progressed and the acute symptoms were brought under control.

Among the series of reported cases were several that had been chronic and had failed to respond to empiric treatment. The ease with which they were brought under control by penicillin therapy was readily demonstrated. One patient who had been treated nine different times with no relief, recovered after two applications of penicillin ointment.

The results definitely prove that penicillin applied in an ointment base overcomes the disadvantages of oral application and cuts down the treatment time to a minimum, provided the indicated surgical measures are also undertaken. It must be remembered that penicillin therapy is a useful adjunct to surgical measures, but does not replace them.

The short treatment time with penicillin ointment in acute pericoronitis, in comparison to the empiric method, indicates its use in the Army Air Forces, where lost time from training is of paramount importance.

Summary

Penicillin ointment therapy is a useful adjunct in oral surgery in the control of local tissue infections. The severity of the case plus the surgical judgment of the operator is the deciding factor in the number of treatments indicated and the proper time for surgical intervention. The remarkable results obtained warrant further study and experiment to determine the value of an ointment containing penicillin in the armamentarium of the oral surgeon.

6. Smith, A. E.: Penicillin Progress. J.A.D.A. 31:1379, October 1, 1944.

TREATMENT OF VINCENT'S INFECTION WITH PENICILLIN

Floyd C. Naegeli and William J. Morginson,† Brigham City, Utah*

When it became evident that employment of the antibiotic mold *Penicillium notatum* therapeutically was producing a new era in medicine, two pilot units for penicillin therapy were established by the United States Army. The first unit was opened at Bushnell General Hospital, Brigham City, Utah, April 1, 1943. It was early observed that penicillin acted to destroy spirochetes and, in February 1944, after the spectacular improvement in a severe Vincent's angina under penicillin, detailed studies were inaugurated.

Penicillin, in therapeutic dosage, is relatively nontoxic. Certain sensitivity phenomena occur infrequently. These may be due to the presence of pyrogens and impurities in the vehicle or to peculiarities directly attributable to penicillin. During the early use of penicillin, reactions were observed to the use of products of certain manufacturers and even certain lots, particularly those of dark color. As impurities are removed and the chemical becomes uniformly light yellow and clear, reactions are less frequent. Local discomfort at the site of injection may be accompanied by pain, swelling, erythema and impaired motion, which, while usually due to the presence of impurities, may be a personal sensitivity phenomenon. Urticaria, dermographia, hyperpyrexia, headache, flushing of the face, tingling in the testes, lacrimation, sneezing and dermatitis venenata have been recorded. Since penicillin is not a protein, these reactions are usually inconsequential and transient and the injections may be continued. In our series, reactions were so infrequent that they were not seriously considered.

For this investigation series, penicillin was administered intragluteally in 25,000 unit doses every three hours day and night until the lesions were sterile and clinically cured. This relatively high dosage was necessary for the early cases to forestall any conclusion that failure was due to underdosage. Later, the dosage was dropped to 15,000 units every three hours, day and night, without any appreciable change in therapeutic results. We plan to conduct a series in which penicillin is administered only over an eight-hour period which, if effective, will reduce penicillin therapy to an ambulatory, office procedure. No local medication except the use of mouth washes of a physiologic solution of sodium chloride was employed, and the patients received no preliminary dental prophylaxis.

Vitamin C was not administered. While certain patients were clinically cured by the exclusive administration of penicillin, dental correction of periodontal pockets, crevices between teeth and overhanging fillings at gingival margins was required for negative smears. Suggestions will be offered regarding speeding the action of penicillin in additional series by combining penicillin therapy with routine dental procedures.

Thirty-five cases of Vincent's infection were treated and thirty-five were cured. These included acute and subacute cases and those presenting ulcers of the tonsils.

Only the severe cases involving the gingiva and oral mucosa which had recurred several times within a year were

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†Captain (MC) U. S. Army.

subjected to penicillin management. The majority were free of organisms in twenty-four hours, although a few required three days, and all patients were clinically well in an average of five days. A few patients, although they were clinically cured of Vincent's infection, as above mentioned, did not show a negative smear within three or four days, but the smear promptly became negative after indicated dental corrections. Routine management suggests such correction the second day of penicillin therapy, when the acute phase of the infection has subsided.

It is to be noted that, in this series, only one patient experienced a recurrence of the infection. This is in marked contrast to the customary treatment of Vincent's infection with solution of hydrogen peroxide, 5 per cent chromic acid or any other medicament, when recurrences are frequently experienced after smears are negative and indicated dental corrections have been made. This study indicates that penicillin may be useful in the treatment of Vincent's infection and is more effective than other drugs commonly used for this purpose.

Cases of Vincent's Infection

	Total No. Cases	Treatment Days (Average)	Total Dosage Units (Average)	Cures
Gingival or oral	23	5	735,000	23
Tonsillar ulcers	12	4½	707,000	12

Report of Cases

CASE 1.—A private, aged 19, first noticed soreness of the right side of the throat February 7, 1944. By February 11, a characteristic indolent ragged-edged and erosive ulcer showing a base covered with dirty gray or yellowish membrane and destroying appreciable portions of the right tonsil had developed. Smears showed many fusiform bacilli and spirilla. There was a right anterior cervical lymphadenopathy. The temperature was normal. On February 13, 25,000 units of penicillin was given intramuscularly every three hours, administration of the drug continuing for four days, with total dosage of 750,000 units. On the second day of treatment, the ulceration was considerably reduced. By the fourth day, healing was complete and smears were negative.

CASE 2.—A sergeant, aged 23, came to the dental clinic March 5, 1944, with Vincent's infection of the gums. Local applications were continued for twelve days before smears were negative. The patient had periodontoclasia with deep periodontal pockets and crevices between the teeth. May 6, the patient came to the clinic with a recurrence of the condition, and, after two days with no improvement, he was admitted to the hospital for treatment with penicillin. The gingivae about the lower incisors were somewhat retracted, red, swollen and ulcerated. The breath had a slightly fetid odor. Smears showed many fusiform bacilli and spirilla. Rapid improvement followed administration of 15,000 units intramuscularly three times a day, and, within two days, the smears were negative.

CASE 3.—A woman, aged 21, reported to the dental clinic July 10, 1944, with sore throat primarily on the left side. The condition became progressively worse and a characteristic ulcer appeared on the left tonsil. Smears showed many fusiform bacilli and spirilla. Penicillin therapy was instituted July 12, 15,000 units being given every three hours, to a total dosage of 600,000 units. There was a rapid decrease in size of the ulcer, with complete healing and negative smears by the fifth day.

CASE 4.—A private, aged 23, was treated for Vincent's infection with local applications May 4, 1944 and again June 9, with negative smears after each treatment. With a recurrence July 6, the gingivae about the molar teeth were reddened and swollen and small areas of grayish exudate were noted between the teeth. Smears showed many fusiform bacilli and spirilla. Penicillin therapy was instituted July 12, with 15,000 units intramuscularly every three hours, to a total dosage of 480,000 units. The gingival condition improved rapidly. At the end of three days, there was no redness or exudate. After completion of the penicillin régime, smears

continued to show a few fusiform bacilli, becoming negative after correction of the dental condition.

CASE 5.—A man, aged 24, noticed soreness of the gingivae in the region of the lower second and third molars on the right side, July 14, 1944. He had been treated with local applications for Vincent's infection from June 20 to June 28, when smears became negative. The gingivae were red and swollen. They overlapped the third molar and, when they were retracted, an area of grayish membrane was revealed. Slight trauma caused bleeding. Smears showed many fusiform bacilli and spirilla. Penicillin therapy, instituted July 18, 15,000 units every three hours, to a total dosage of 600,000 units over five days, resulted in rapid subsidence of swelling and ulceration, with clinical cure and negative smears. There has been no recurrence.

Since the completion of the above-mentioned series, penicillin therapy in the management of Vincent's infection has been conducted as follows: (1) smears from the infected areas; (2) penicillin, 25,000 units, administered intragluteally every three hours, for five doses only, the patient remaining on duty; (3) indicated dental treatment on the second day, when the redness and inflammation had usually subsided, and (4) smears repeated on the third day. The penicillin injections were usually given at 8 a.m., 11 a.m., 2 p.m., 5 p.m. and 8 p.m. Thirteen patients have been treated to date. Ten of these showed complete subsidence of the infection and smears were negative after one course. Two patients required a second course and one patient required a third course before dismissal as cured. There have been no recurrences. The eradication of Vincent's infection can be accomplished with penicillin in the ambulatory patient remaining on duty status, provided the necessary routine dental procedures are carried out.

Summary and Conclusions

1. Penicillin is considered useful in the treatment of Vincent's infection of the gingivitis, stomatitis, tonsillar ulcer and angina types.

2. Vincent's infection may be clinically cured by the exclusive use of penicillin parenterally, negative smears being produced without dental procedures in the majority of instances. Periodontal pockets and crevices between the teeth or pericoronal flaps, when present, require correction before smears are negative.

3. Mouth washes or extensive applications of solution of hydrogen peroxide or of 5 per cent chromic acid are not required in the management of Vincent's infection.

4. In our experience, the time required for cure of Vincent's infection has been reduced from seven to fourteen days for gingivitis, and for tonsillar ulcers and angina, with the use of local applications, to a period of from three to four days with exclusive penicillin therapy parenterally, and to two days when combined penicillin parenteral therapy and dental management are employed.[1]

1. Preliminary reports: Sweeney, J. S., et al.: Summary of Experiences in Use of Penicillin in Medical Conditions. J. Lab. & Clin. Med., 30:132, February 1945. Morginson, W. J.: Clinical Use of Penicillin in Dermatology: J. South. M. A., to be published.

ORAL MANIFESTATIONS OF ERYTHROBLASTIC ANEMIA*

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Erythroblastic anemia (Mediterranean disease, thalassanemia), first described by Cooley,[1] in 1925, is generally recognized as a distinct entity characterized by a hemolytic anemia, enlargement of the spleen, the presence of large numbers of nucleated red blood cells in the peripheral blood, changes in the bones and familial and racial incidence. There are mild and atypical forms of the disease, such as "target cell anemia," described by Dameshek.[2] It is suggested that the disease is transmitted through patients with target cell anemia, and that typical cases of erythroblastic anemia result from intermarriage of persons having the mild form of the disease.[3]

REPORT OF CASE

History.—A boy, aged 11 years and 8 months, was referred to the hospital April 25, 1944, by the district nurse because of cough, dyspnea and general malaise.

The family history revealed that two sisters of the patient died of Cooley's anemia at the age of 2½ and 12 years, respectively. Three siblings were living and well. The parents were of Italian origin, and their family came from a small village in southern Italy. The father's mother died at the age of 65, and she was known to be very anemic, as was the maternal aunt, who died at the age of 21, after childbirth.

Fig. 1.—A. T., aged 12; showing bulging of anterior portion of maxillae with teeth constantly in view, high cheek bones and wide-set eyes.

The prenatal period was uneventful and the patient was born at full term at home by a normal spontaneous delivery. The birth weight was 10½ pounds. The immediate postnatal condition was good and the patient was breast fed. Slight jaundice was first noticed in a well-baby clinic at the age

*From the Tufts College Dental School, Department of Orthodontics, the Department of Pediatrics of the Tufts College Medical School and the Boston Floating Hospital.

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2. Dameshek, W.: "Target Cell" Anemia. Erythroblastic Type of Cooley's Erythroblastic Anemia. Am. J. M. Soc., 200:445-454, October 1940.

3. Wintrobe, M. M., and others: Familial Hemopoietic Disorder in Italian Adolescents and Adults; Resembling Mediterranean Disease (Thalassemia). J.A.M.A., 114:1530-1538, April 20, 1940.

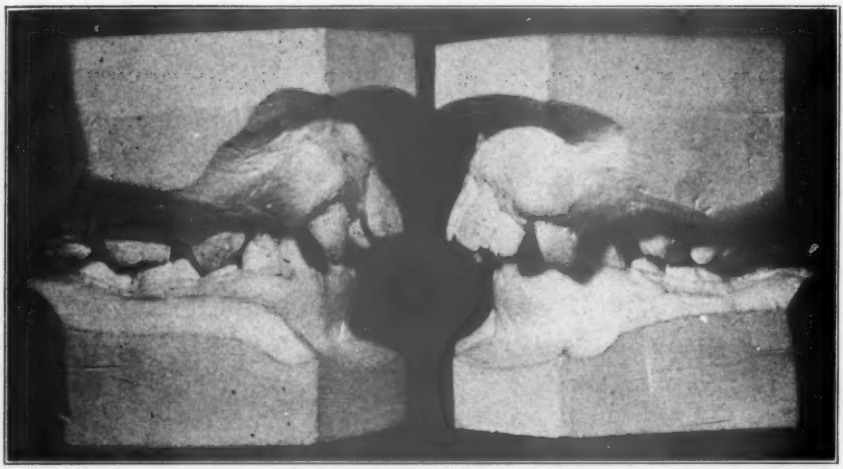

Fig. 2.—Models showing marked overbite with teeth in occlusion.

Fig. 3.—Models of mouth. Left: Maxillary teeth, showing irregularity with bilateral diastema between cuspid and first bicuspid. Right: Mandibular teeth, showing regularity.

of 9 months. At this time, the abdomen was quite protuberant and the weight became stationary. The patient was referred to the children's hospital, where a diagnosis of Cooley's anemia was made, and here he was kept under observation and hospitalized on various occasions. At 5 years of age, splenectomy was performed at the Massachusetts Memorial Hospital. The patient had chickenpox at 9 years of age, and was hospitalized with pneumonia on one occasion. From the fifth to the seventh year of age, he had multiple fractures of the legs and arms, which left him incapacitated and unable to walk without orthopedic shoes.

Examination.—Physical examination revealed that the boy was very small for his age. His head was enlarged and quadrangular, with protuberance of the frontal and parietal bossae. The subcutaneous fatty tissue was sparse. The skin was slightly jaundiced with an underlying sallow, muddy color. The mucous membranes were pale

Fig. 4.—Roentgenogram of hands, showing widening of medullary portion, increased radiability with prominent trabeculations and extreme thinning of cortices.

and cyanotic. The nails were also cyanotic. The eyes, which reacted well to light and in accommodation, gave the impression of being slightly protruding and were set far apart. No epicanthal fold was observed. The mouth was held open constantly (Fig. 1) because of the marked hypertrophic change in the anterior portion of the maxilla. The mucous membrane of the maxilla was thin and had the appearance of being stretched tightly over the bone. Although the maxillary teeth occupied irregular positions in the arch curve, those in the mandibular arch were in better alinement, with the exception of slight irregularity in the incisor region. All cervical and inguinal glands were slightly enlarged, but not tender.

The abdomen was protuberant and the liver edge was felt 3¾ inches below the costal margin in the right mammary line and was tender on palpation. The kidneys were not palpable. The genitalia were normal. The extremities had little muscular development and the muscle tonus was generally poor.

Hematologic Findings.—The red blood count was 1,070,000 and the hemoglobin 2.5 gm. (16 per cent.) The corrected white blood count was 17,000. The total nucleated cell count was 42,500, 60 per cent of these cells being nucleated red blood cells. The blood platelets numbered 800,000. The reticulocyte percentage was 10.3. The hematocrit reading was 12; the mean corpuscular volume, 120. The icteric index was 28. The total bilirubin content of the blood serum was 3.7 mg. per hundred cubic centimeters (direct 0.9, indirect 2.8). The resistance span of the erythrocytes in hypotonic solutions of sodium chloride was widened. The

Fig. 5.—Roentgenogram of skull, showing outer layer of cortical bone thin and porous with small radiating spicules standing perpendicularly to tables of skull.

differential leukocyte count (in percentage) was as follows: polymorphonuclears, 40; lymphocytes, 40; monocytes, 2; eosinophils, 2; basophils, 1; myelocytes, 9; metamyelocytes, 5; blast forms, 1. The stained blood smear showed extreme variation in the erythrocytes in size, shape and hemoglobin content. There were many target cells, and large numbers of nucleated red blood cells at different stages of development. Numerous cells contained Howell-Jolly bodies and a few showed basophilic stippling.

Treatment.—During the first days in the hospital, the patient was given a series of transfusions of blood, totaling 700 cc. The red blood cell count increased to about 3,000,000 and the hemoglobin to 6 gm. (40 per cent). There was no other remarkable change in the laboratory findings and the counts have remained essentially the same since this time.

Clinical Findings in Oral Cavity.—The mucous membrane of the maxilla appeared thin, pale and cyanotic with moderate gingivitis in the region of the irregular maxillary incisors. These teeth were prominently in view owing to enlargement of the bone, which kept the lips apart. When the jaws were closed, there was a marked overbite. (Fig. 2.) In the maxillae, there were fourteen well-developed teeth, in which there were six amalgam fillings. In addition to irregularity in the arch curve, there was a bilateral diastema between the cuspid and the bicuspid about one and one-half times the width of a bicuspid. Although there was enlargement of the maxillary process, the teeth were very firm.

Fig. 6.—Roentgenogram of maxilla, showing increase in size and change in trabecular pattern of bone, as well as increase in size of cancellous spaces.

Fig. 7.—Roentgenogram of mandible, showing increase in labial-lingual diameter. The trabecular pattern of this bone has changed and the cancellous spaces are even larger than those seen in the maxilla.

The mucous membrane of the mandible was firm, pale and cyanotic. The mandible was also expanded, but the teeth remained in fairly good alinement. There were fourteen teeth, in which were four amalgam fillings, with no other serious defects except the body. (Fig. 4.) An x-ray picture of the skull showed the outer layer of cortical bone to be thin and porous. (Fig. 5.) The diploe was very prominent and there were small spicules radiating perpendicularly from the tables of the skull. The rest of

Fig. 8.—Roentgenogram of left side of mandible, showing increase in vertical dimension of mandible as well as extreme thinning of cortical layer of bone. A third unerupted molar is also seen.

for the right mandibular biscuspid, which showed a marked hypoplastic defect. All the mandibular teeth were very firm. (Fig. 3.)

Roentgenographic Findings in the Skull and Oral Cavity.—Roentgenographic examination of the skeletal structures revealed changes involving virtually all the bones of the skull plate had a fine, spongy appearance.

The maxilla was tremendously increased in size labially, laterally and vertically. There was a change in the trabecular pattern, showing enlarged cancellous spaces. The roots of the maxillary teeth had been displaced, causing a malalinement of these teeth. There was

a bilateral diastema between the cuspid and the first bicuspid. (Fig. 6.)

The anterior portion of the mandible showed a great increase in the labiolingual diameter. The posterior portion was increased in size buccally and there was a remarkable increase in vertical dimension. (Fig. 7.) The cortical layer was very thin throughout, and the teeth were in fairly good alinement. Here too, the trabecular pattern of the bone was normal and the cancellous spaces were larger than those found in the maxilla. A right and a left unerupted third molar were seen. (Figs. 8 and 9.)

Intra-oral roentgenograms showed a generalized alteration in the trabecular pattern of the bone as well as a reduction in its density. (Fig. 10.)

Fig. 9.—Roentgenogram of right side of mandible, showing unerupted third molar.

SUMMARY

Although erythroblastic anemia is not a disease of the bone, these structures become involved secondarily. In this case, the disease was diagnosed at 9 months of age and from that time on the bone changes in the skeletal structures increased. The bone changes seen in both the maxilla and the mandible in no way affected the pattern of tooth exfoliation and eruption. The patient, at age of 12, has a full complement of teeth with four unerupted third molars.

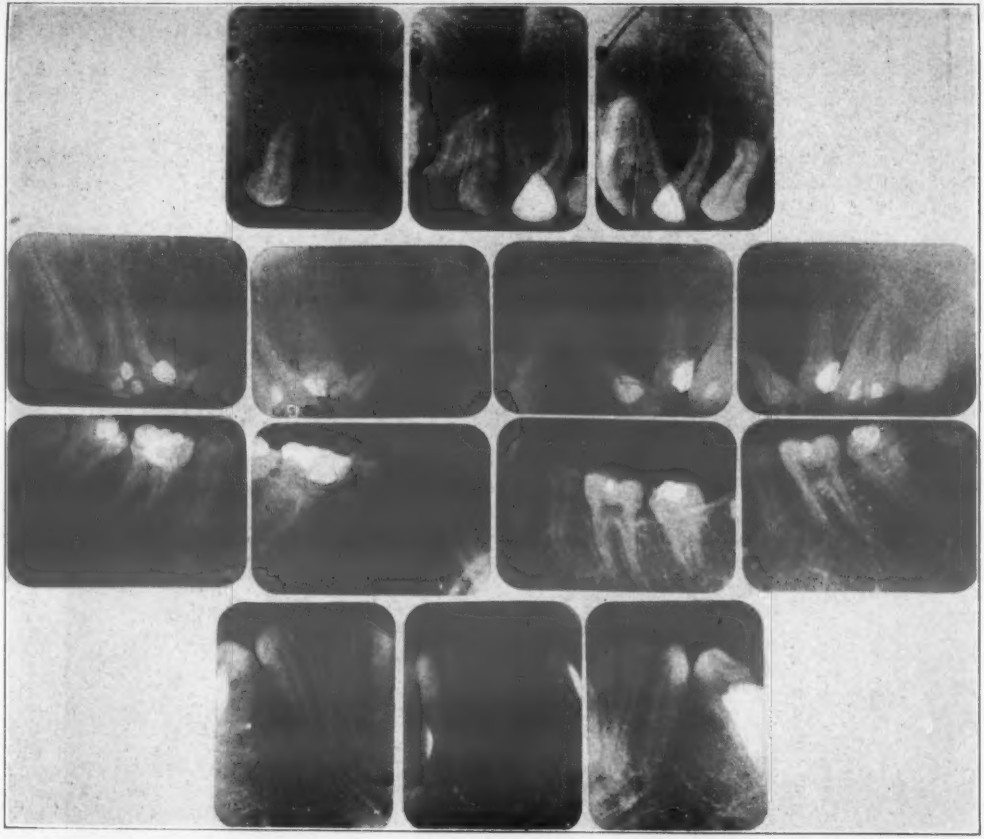

Fig. 10.—Intra-oral roentgenogram, showing generalized alterations in trabecular pattern of bone as well as reduction in its density.

CAUSES, CLASSIFICATION AND CORRECTION OF MANDIBULAR IMPACTION

Ferdinand Griess, D.D.S., Lincoln, Nebr.*

I. Causes of Impaction

Various theories have been advanced regarding the etiology of impaction of the mandibular third molar. All of these theories perhaps have validity in that they may present certain contributing causes of this condition in the human race.

Several of the theories regarding the causes of such impaction are[1]:

1. The Mendelian theory, according to which the individual inherits small jaws from one parent and a complement of large teeth from the other. The mandibular third molar, since it is the last tooth to erupt, will not have the space required for its eruption, and the end-result will be impaction either in the second molar of the mandible or in the ramus of the jaw. (Fig. 1.)

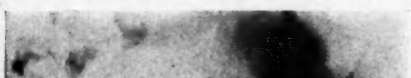

Fig. 1.—Small mandible with impaction of second and third molars.

2. The phylogenic theory, according to which nature tries to eliminate an organ that she does not need. It is definitely known that the jaws of man have decreased in size, this condition resulting probably from lack of function. It is also known that in about 10 per cent of the Caucasian race, the third molars are lacking. Nature has eliminated that which she did not use.

3. The pathologic theory, according to which impaction of the third molar is the result of osteosclerosis in the third molar area, supposedly caused by early disease of the adjacent molars. Since too many normal first and second molars are to be found in a high percentage of cases of mandibular impaction, this theory is to be questioned.

4. The orthodontic theory, proponents of which attribute the impaction to a condition wherein narrowed dental arches are well formed at the time that the mandibular third molar attempts to erupt, insufficient space being available for normal eruption. This condition is without doubt the cause of impaction in a great number of cases.

5. The endocrine theory, which is based upon a fundamental assumption that an imbalance of endocrine activity may be a contributing factor in the lack of growth of the jaws, this lack providing a cause for impaction.

II. Classifications of Impactions

George Winter, in his work on the impacted mandibular third molar, has classified the various types of impaction of the mandibular third molar on the basis of four important points: (1) the

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1. Durbeck, W. E.: Impacted Lower Third Molar. Brooklyn: Dental Items of Interest Publishing Co., 1943, pp. 4-7.

position of the crown; (2) the character of the root formation; (3) the nature of the osseous structure surrounding the tooth, and (4) the position of the third molar in relation to the second molar.

He has likewise presented a simplified classification of the different types of impaction, this classification being based upon the position and location of the impacted tooth. Types of impaction listed in this simplified classification are: (a) vertical; (b) mesioangular and distoangular; (c) horizontal; (d) buccoangular and linguoangular; (e) complete lingual, and (f) unusual.[2]

III. Elimination of Impaction

A. Preoperative Aspects.—1. Knowledge of oral anatomy: Since all surgery is based upon anatomy, it is essential not only that the operator have a thorough knowledge of oral anatomy, but also that he constantly keep in mind the existence of the following structures: (a) the retromolar triangle, with its external and internal oblique ridge, and the retromolar fossa lying within this triangle; (b) the mylohyoid ridge; (c) the buccinator nerve; (d) the mandibular nerve, and the canal with its contents; (e) the lingual nerve; (f) the fifth, or trigeminal, nerve; (g) the muscles and ligaments related to the mandible; (h) the floor of the mouth; (i) the lymphatic system, and (j) the fascial spaces.

2. Clinical examination of the patient: As a preoperative procedure, clinical examination is most important.

(a) Anemia. Anemic patients, for instance, are always a poor risk. Such patients may generally be recognized by the pallor of the skin, mucous membrane and conjunctiva. This type of patient should be carefully observed for bleeding and clotting time. Moreover, there should be a physical checkup and treatment, if necessary, by the patient's physician before surgical operation is attempted.

(b) Heart ailments. Patients should be observed carefully for symptoms of heart ailments. Shortness of breath upon exertion; swelling of extremities, particularly the ankles; a tendency toward cyanosis, or sharp pains down the left arm, including the last two fingers—any or all of these should be regarded as possible indications of heart disease. In this type of case, the operator should use the necessary precautions.

(c) Leukemia. Clinical examination may likewise warn the operator regarding the presence of leukemia, since the mouth symptoms in leukemia are among the first to appear. These symptoms vary from gingivitis to bleeding of the gums, ecchymosis and formation of petechiae. Furthermore, there is often a severe sepsis of the mouth. When such conditions exist, it is well to get a blood picture and consult the internist, since this disease will prove fatal.

3. Mouth hygiene and prophylactic treatment: As a preoperative procedure in the removal of impacted teeth, the operator should determine the condition of the mouth hygienically. Prophylaxis, if indicated, should be given before surgical measures are attempted.

If a portion of the impacted crown is exposed, the patient should be questioned regarding pain in that area. If there is any pain, and the soft tissues are inflamed, the case should be treated for Vincent's infection. Some years ago, Herbert H. Waite, of the University of Nebraska, took cultures from underneath the flaps of the mandibular third molars of more than 200 persons, and, in every case, he obtained Vincent's spirochete and the fusiform bacillus on culture.

It seems clear, therefore, that patients in whom a portion of an impacted third-molar crown is erupted should, in case of pain and inflammation of the tissues, be given preoperative treatment. In such

2. Mead, S. V.: Oral Surgery. St. Louis: C. V. Mosby Co., 1940, p. 563.

Fig. 2.—Soft odontoma in boy aged 8 years.

cases, the area under the flap should first be cleaned with hydrogen peroxide. Then a wick made of a small piece of stringlike cotton dipped in iodine (7 per cent) or chromic acid (3.5 per cent) should be placed under the flap and left for twenty-four hours. It should then be changed, and the patient should be instructed to use hot irrigations until the inflammation has subsided or the condition has localized.

A flap which yields frank pus does not make a surgical operation hazardous. An inflamed flap that feels sore on palpitation and does not yield frank pus must be treated as described above before surgical procedures are undertaken.

4. Traumatic inflammation: In connection with the removal of an impacted mandibular third molar, the possibility of traumatic inflammation, caused by the presence of the upper third molar, must always be taken into consideration. Should such a condition exist, the upper tooth should be removed before removal of the impacted lower molar.

Indeed, in all cases of mandibular impaction, the upper third molar should be removed. Invariably, this tooth will elongate and pocket formation result, owing to packing of food in the interproximal space. This pocket formation will eventually cause the loss of both the second and the third molars.

5. Importance of the roentgenogram: The removal of an impacted tooth should never be attempted without a roentgenogram. In fact, every tooth, including deciduous teeth, should be x-rayed before removal. The case depicted in Figure 2 proves the truth of this assertion. In a fine, healthy boy, aged 8 years, the first permanent molar on the left side was missing. The roentgenogram is shown in Figure 2. After removal (Fig. 3) and biopsy, the abnormality proved to be a soft odontoma.

The roentgenogram should definitely show all of the impaction area, including the roots and part of the ramus. In many cases, this will require both intra-oral and extra-oral films.

B. Operative Procedures.—1. General considerations: (a) Removal of external oblique ridge. A knowledge of the anatomy of the mandibular third molar is highly important to the operator. It must be remembered that 90 per cent of all mandibular third molars are of the anatomic form of the mandibular first or second molar. It follows that the greatest diameter of the occlusal third of the mandibular third molar is the mesiodistal, and the greatest diameter of the middle third is the buccolingual. With these facts in mind, one can easily understand why, in removing a mandibular third molar, it is important that the external oblique ridge be cut away, down to a point just

Fig. 3.—Condition after removal of odontoma. (Compare Fig. 2.)

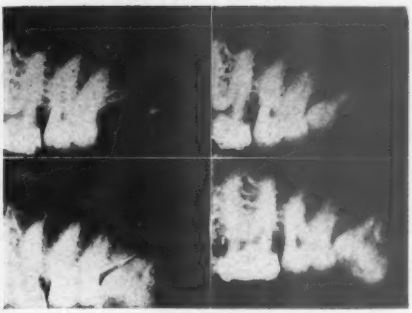

Fig. 4.—Buccal and distobuccal groove.

below the middle third of the impacted tooth.

(b) Splitting the tooth. If a tooth is to be split by placing the chisel in the buccal groove (Fig. 4), one should make sure that the chisel *is* placed in the buccal groove and not in the distobuccal groove. If this error is made, only the distobuccal cusp will split. Furthermore, for the desired results, i.e., dividing the tooth in half, the chisel must be in line with the long axis of the tooth.

(c) Use of elevator with split tooth. After the tooth has been split, the elevator should be placed on the buccal aspect of the distal half between the root and cortical plate of bone, and the distal portion of the tooth removed by being brought forward and upward. The elevator should then be placed mesially from the crown at the interproximal space or just below the contact point of the mesial half of the tooth, and this portion of the tooth brought upward and backward into the space created by removal of the distal half. If removal is in conformity with the procedures outlined above, little of the bony process will be destroyed.

(d) Laying of mucoperiosteal flap. If an impacted tooth lies below the soft tissues, a mucoperiosteal flap will be necessary. For the incision, two scalpels are required, one with a straight blade, the other having a curved blade with the cutting edge on the concave side. First, the incision should be made in a distomesial direction, slightly buccally from the lingual ridge of the retromolar triangle. This incision should be carried forward to the distal surface of the second molar, and should originate at a point a sufficient distance distally to include the entire operative field. Next, the distal mucosa around the second molar should be cut to the distobuccal angle of the second molar, the operator using the curved blade. Then, with the straight blade, from the junction of the distal and buccal surfaces of the second molar, the incision should be brought downward and forward to the desired length. This incision must be long enough to give a clear view of the operating field. (Fig. 5.) The incisions described above must be carried through the periosteum, so that when the flap is raised with a sharp periosteotome, the periosteum will be lifted with the flap.

After the flap has been reflected, the mucosal flap should be trimmed in a straight line. This trimming of the flap insures that after the bony process and tooth have been removed, one stitch across and just behind the second molar will draw the flap snugly around the second molar, forming a saucer-like concavity. A flap of this type will never allow a pocket formation distally from the second molar. Such formation, which is of frequent occurrence, is highly detrimental to that tooth.

2. Special considerations: (a) Removal of vertically impacted tooth under

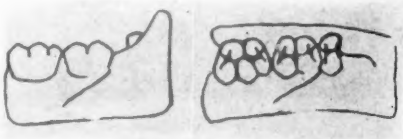

Fig. 5.—Incisions for mucoperiosteal flap.

the cervical aspect of the second molar. A vertically impacted tooth that lies beneath the cervical aspect of the second molar (Fig. 6), which takes the form of the first or second molar and is in a bucco-angular position, may be treated thus: The external oblique ridge should be cut away with a chisel to just below the middle third. Next, with a chisel and mallet, the tooth should be divided, the chisel having been placed in the buccal groove in line with the long axis of the tooth. If, owing to the shape of the tooth, the bony process covers the tooth above the contact point, it may be necessary to remove a small portion of the bone distally from the tooth. Then, with the elevator at the distobuccal angle (Fig. 7), the distal portion of the divided tooth, by means of a forward and upward movement, can easily be removed.

Fig. 6.—Vertically impacted tooth lying beneath cervical aspect of second molar.

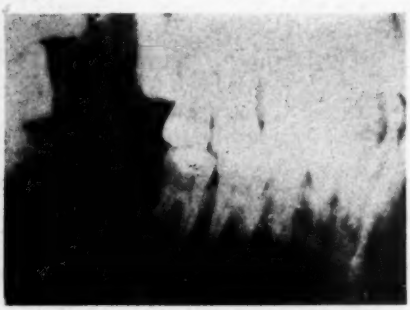

Fig. 7.—Appearance after distal half of tooth had been removed. (Compare Fig. 6.)

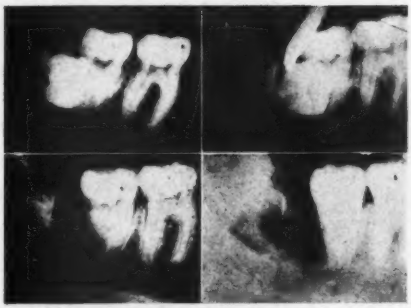

Fig. 8.—Condition after removal of mesial and distal halves. (Compare Figs. 6-7.)

Fig. 9.—Linguo-angular position.

Finally, with the elevator at the mesiobuccal angle (Fig. 8), the mesial portion of the tooth, by means of a backward and upward movement, may likewise be removed.

(b) Elimination of a linguo-angular impaction below the internal oblique ridge. If the tooth lies in a linguo-angular position and is below the internal oblique ridge (Fig. 9), either the ridge must be cut away or the whole crown must be split at the cervical line. If the latter procedure has been adopted and the crown has been split off, a gouge should be adjusted above the distal root and tapped lightly along the course of that root, in order that the elevator may

Fig. 10.—Horizontal impaction above cervical line; steps in removal.

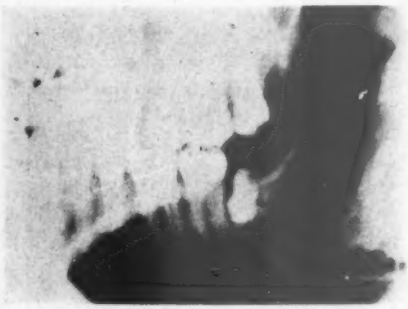

Fig. 11.—Horizontal impaction just below cervical line.

be placed in position. With the elevator properly placed, the bony process becomes the fulcrum, and the distal root is removed by being brought forward into the space created by removal of the crown. Then, with the elevator in the space created by the removal of the distal root, the mesial root can be removed by being brought forward.

(c) Removal of horizontally impacted tooth above or below the cervical line of the second molar. A horizontally impacted tooth that lies above the cervical line may be split along the long axis (Fig. 10) and the distal half removed by being brought forward. The mesial half may then be removed by being brought upward and slightly forward.

If the tooth lies below the cervical line of the second molar (Fig. 11), the whole crown should be split off just below the cemento-enamel junction, and the external oblique ridge cut away to a point just below the buccal groove and including the cemento-enamel junction at the cervix. The crown, after being severed from the root, should again be split through the buccal groove. The distal half of the crown may then be removed. (Fig. 12.) If the mesial half of the crown is rather low and cannot be dislodged, the operator should place a chisel in the center of this mesial half and split this portion of the crown in that direction. These two parts of the mesial half of the crown can then be

Fig. 12.—Case shown in Figure 11; coronal portion removed.

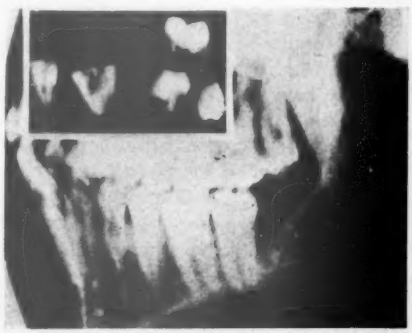

Fig. 13.—Completely impacted tooth removed in five pieces.

Fig. 14.—Impaction into ramus.

Fig. 15.—Condition after removal of coronal portion of tooth. (Compare Fig. 14.)

removed by lifting the buccal portion and the lingual portion separately. (Fig. 13.)

After the crown has been removed, the gouge should be placed above the distal root and lightly tapped. The root should then be brought forward and downward with the elevator. The operator may then remove the mesial root by breaking through a part of the interseptal process and bringing this root forward into the cavity. If the tooth has but one root, its root should be treated as the distal root.

(d) Elimination of impaction into the ramus. The removal from the ramus of an impacted third molar becomes a relatively simple matter through the splitting method. In the removal of such an impacted tooth, the crown should be split at the cervical line (Fig. 14), the chisel having been set in such a way that the cutting edge will produce a crack which is greater at the mesial than at the distal part of the tooth. Should the crown still be anchored too high in the ramus, another small section of the tooth below the crown should be split off. With the removal of this section of the tooth, the crown will have a tendency to loosen. After the coronal portion has been removed (Fig. 15), the root or roots should be brought up into the space created by removal of the crown. (Fig. 16.)

Fig. 16.—Condition after elimination of impaction into ramus.

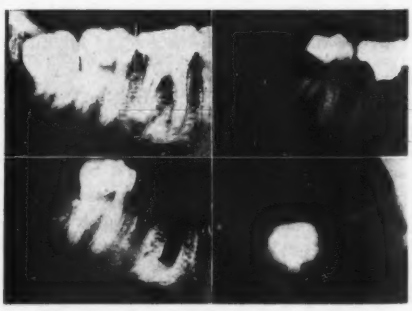

Fig. 17.—Unusual type of impaction into ramus. Only two roots can be seen.

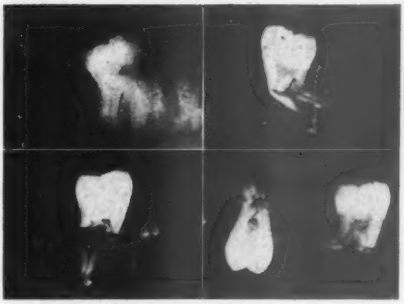

Fig. 18.—Tooth in Figure 17, after removal; showing three roots.

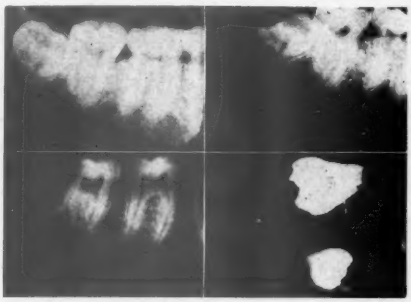

Fig. 19.—Impacted tooth not fully developed; distal portion split; removal complete.

(e) Elimination of unusual impaction. In unusual types of impaction, the tooth may lie in almost any position. It may have several roots, some of which are usually near or below the mandibular canal. Of such cases of impaction, only one type will be presented here. (Fig. 17.)

In this case, the roentgenogram shows two roots. The distal root follows the canal and then turns upward at almost a right angle. The mesial root follows the same course. The roentgenogram shows only the conditions mentioned above.

Because of a slight impaction into the ramus and because of the type of root, both conditions being shown in the film, it was necessary that the tooth be split rather low on the root. After removal of the crown and part of the root, the gouge was placed above the distal root, and a part of the bone was removed. Then, with a spoon excavator below the root, this portion of the distal root, by being brought upward and backward, was also removed.

After the distal root had been extracted, the removal of the second root was a simple matter. A postoperative film revealed the presence of yet another root, toward the lingual aspect. Through the medium of several films, the exact position of this third root was definitely established, and its removal presented no problem. (Fig. 18.)

(f) Removal of partially developed impacted teeth and splitting of loosened tooth. The only tooth that cannot be split is a loose tooth. If a tooth has once been loosened, no attempt should be made to split it. Not infrequently, an operator attempts to remove an impacted tooth that is not fully developed. This is the type of impacted tooth that is subject to loosening, and if such a tooth is loosened, an attempt to remove it by splitting it will end in failure. Yet, if one keeps in mind the anatomy of the tooth, as well as that of the bony processes which surround it, even an impacted tooth that is not fully developed can be split successfully (Fig. 19).

(g) Use of drill and surgical bur in removal of impacted teeth. In the removal of many impacted teeth over a number of years at the University of Nebraska, no use has been made of either the drill or the surgical bur. Furthermore, there has been less trauma, less swelling, less trismus and certainly less pain than when the electric motor, bur and drill were commonly used in surgical procedures connected with impaction.

THE DENTAL PULP AND CONTIGUOUS STRUCTURES: CLINICAL CONSIDERATIONS

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The majority of people do not seek dental attention until they are conscious of some unusual condition. In a high percentage of cases, deep caries is the condition found. It is not always necessary to remove the pulp from such a tooth; but it is always necessary to treat such a tooth skilfully.

Local anesthesia enables the dentist to find his way through many difficult situations, but is sometimes used unwisely. Anesthesia should be withheld until certain tests have been made to determine the condition of the pulp and periodontal membrane. Instrumentation, percussion, heat, cold and electrical stimulation are all useful and may clarify x-ray findings. Having noted such diagnostic signs as responsive tissue will give us, we can often employ anesthesia more advantageously; and it will sometimes be found that its use is superfluous or even contraindicated.

Treatment of Deeply Decayed Teeth

In all cases of deep caries, the rubber dam, which not only excludes saliva from the field of operation, but also provides protection when germicides are used in close proximity to the gingiva, should be used. The possibility of infecting the pulp, if it is exposed in cavity preparation under such conditions, is greatly lessened and root-canal therapy is simplified. If it is possible to remove all the carious matter without exposing the pulp, the cavity is ready for a base and a filling. The material which is placed in the cavity prior to the insertion of a metallic filling or inlay should be carefully selected.

For a number of years, the so-called germicidal cements were popular for this purpose. Oxyphosphate of copper, especially the red variety, was widely used. It was believed that copper cement had the property of destroying bacteria that might still be present in the dentinal tubules, that it was an excellent nonconducting base and that it was a veritable panacea. When a pulp died under such treatment, it was generally supposed that no treatment would have saved it. Now copper cement is a germicide, but it is also a strong irritant. Unless a substantial layer of dentin lies between it and the pulp, its presence will have a decidedly injurious effect on the pulp. Gurley and Van Huysen,[1] in this country, and Manley,[2] in Australia, have proved this point by extensive investigation in experimental animals.

Another remedy advocated for pulp protection, a cement consisting essentially of zinc oxide, resin and eugenol, dates back to 1894. It has a far better record clinically, but it remained for these investigators to show why the record was different. In summary, Manley's 1940 report is as follows: Dogs were used as subjects. Under the influence of hypnotic drugs, cavities were prepared and filled with various materials. The

*Associate professor and head of the Division of Oral Medicine, Marquette University Dental School.

1. Gurley, W. B., and Van Huysen, Grant: Histologic Changes in Teeth Due to Plastic Filling Materials. J.A.D.A., 24:1806, November 1937.

2. Manley, C. B.: Investigations into Reactions to Various Filling Materials. D. J. Australia, 12:549, September 1940.

materials tested were silver amalgam, silicate cements, zinc oxide-eugenol pastes and germicidal cements. The animals were permitted to live for certain periods. Histologic examination disclosed that the use of all these substances, except zinc oxide-eugenol paste, resulted in definite pathologic conditions in the dentin and pulp.

Some time ago, Wallace,[3] of the A.D.A. Bureau of Chemistry, decried the exaggerated claims made for various proprietary pulp protectors, and suggested a simple formula containing zinc oxide, resin, eugenol and a minute quantity of zinc acetate to reduce the setting time. My experience with this material was not entirely satisfactory. A former associate, J. M. Rose, thereupon made a number of experiments, changing the proportions of the several suggested ingredients and adding a quantity of magnesium oxide to facilitate mixing the compound. Magnesium oxide was chosen because it forms a considerable part of a proprietary zinc oxide-eugenol mixture that has an excellent clinical record. This cement mixes rapidly, and the average mix sets in five minutes. It does not have to be made into a thick paste, and can therefore be placed in close proximity to the pulp without pressure. The formula is as follows:

Powder:	
Resin, Staybelite, 100 mesh	30.0
Magnesium oxide, C.P.	28.0
Zinc oxide, C.P.	40.5
Zinc acetate, C.P.	1.5
Liquid:	
Eugenol	

The Treatment of Fractured Teeth

In fractured teeth, we again have the pulp to deal with. Since fractures of the teeth occur most frequently among children, and since the involved tooth is often not fully developed, care of the pulp is sometimes a very distressing problem. In the simple cases, that is when the pulp is not actually exposed, but nearly so, there is nothing better than the above-mentioned zinc oxide compound, held in position by a carefully contoured celluloid crown form. This can be renewed from time to time over a period of from eight to ten weeks. Secondary dentin is laid down rapidly in the teeth of young people because the pulps are large and vascular. When the tooth is no longer extremely sensitive to thermal change, the crown form and cement can be dispensed with. The sharp edges of the tooth are then gently smoothed, and nothing further is done until the tooth has fully matured. The ultimate restoration will depend upon the extent of the injury.

The second type of fracture is one in which the pulp is exposed, but which offers a favorable prognosis because the apical foramen is fully developed, or nearly so. Here, sound root-canal therapy can save many teeth. If the basic principles of aseptic surgery are strictly adhered to, if escharotic drugs are omitted from the procedure and if foreign substances are not forced beyond the apex, the prospect of successful treatment is excellent. There are many cases on record of such teeth functioning quite as well as vital teeth, because, as Coolidge,[4] Kronfeld[5] and others have so strikingly shown, new cementum is deposited in the apical foramina. In effect, these teeth are like vital teeth in which the canals have been obliterated by calcific deposits common to old age.

The whole picture is changed when an immature tooth is fractured into the pulp. The prime purpose of the dental

3. Wallace, D. A., and Hansen, H. L.: Zinc Oxide-Eugenol Cements. J.A.D.A., 26: 1536, September 1939.

4. Coolidge, E. D.: Status of Pulpless Teeth as Interpreted by Tissue Tolerance and Repair Following Root Canal Filling. J.A.D.A., 20: 2216, December 1933.

5. Kronfeld, Rudolf: Histopathology of Teeth and Their Surrounding Structures. Philadelphia: Lea & Febiger, 1933, p. 188.

pulp is to supply the tooth with nourishment until it has fully developed. If severely damaged by trauma or infection, the pulp will soon become necrotic and lose its function. Without the pulp, the tooth cannot mature. With these facts in mind, we sometimes excise that part of the pulp which protrudes from the fractured pulp cavity and, having arrested the hemorrhage, cover the stump with a bland compound. Zander[6] has suggested calcium hydroxide for this purpose. Gottlieb and his co-workers[7] advocate the use of dentin powder, obtained by the simple expedient of running a round bur in the adjacent dentin in such a manner that the particles fall on the exposed pulp. Either of the substances suggested is covered with paraffin and then cement. The success of such a procedure is obviously dependent on (1) the extent of infection in the pulp before operation and (2) the degree of infection that the particular pulp can tolerate. Sometimes, a large pulp with an abundant blood supply can withstand considerable abuse. Treatment is worth the effort, as extraction is the only alternative. It is my suggestion that 1 per cent chloramine-T be used to wash the surface of the exposed pulp before operating, and that thromboplastin be employed to arrest the hemorrhage that follows excision of the pulp fragment.

Fractures of the root also result from various accidents. If the injury is entirely within the epithelial attachment, the prognosis is favorable. Austin,[8] of the Mayo Clinic, reported forty cases several years ago. Of this number, thirty-one responded to vitality tests after treatment. This high percentage of success indicates that the dental pulp can withstand a great deal of traumatic injury, in the absence of infection. All fractured teeth should be roentgenographed to determine the extent of the fracture. Likewise, all fractured teeth should be tested for vitality. If the fracture is simple and the pulp tests are positive, the affected tooth should be immobilized with an appliance similar to those used by orthodontists for that purpose.

Precautions in Preparing Teeth for Restoration

Sometimes, in replacing pulpless teeth, we damage a normal tooth, so that it, in turn, becomes pulpless. When operating under local anesthesia, we should remember that excessive heat can easily damage a pulp. After preparation of the abutment teeth, it should be borne in mind that the dentinal tubules are now exposed in many places and that they should be protected from the ingress of bacteria during the period in which the appliance is being made. Zinc oxide compound, held in position by celluloid crown forms or aluminum caps, should be used routinely. Also, it should be routine practice to protect the tubules against the injurious action of oxyphosphate cements by thoroughly drying and varnishing deep cuts in abutment teeth before the final cementing process.

In completing restorations of this kind, the occlusion should always be carefully adjusted so that undue strains are not placed on the periodontal structures. The life of prosthetic appliances is dependent on the consideration given living tissue quite as much as on the mechanical excellence of construction.

Pulp-Involved Teeth to Be Retained

Roentgenograms are almost universally used today, and there is no better means to determine the status of pulpless teeth.

6. Zander, H. A.: Reaction of Pulp to Calcium Hydroxide. J. D. Res., 18:373, August 1939.

7. Gottlieb, Bernhard; Orban, Balint, and Stein, George: Root Treatment in Case of Vital Pulp. Tr. Australian D. Cong. (Eighth), 1933, p. 99.

8. Austin, L. T.: Review of Forty Cases of Retained Fractured Roots of Anterior Teeth. J.A.D.A., 17:1930, October 1930.

Simpson[9] has discussed this thoroughly. We must have good roentgenograms. It is only by a careful study of the structure of the bone adjacent to the root end that we can arrive at the true condition of the tooth. Of course, where there is gross infection and much periapical bone has been lost, a picture with fine detail is not necessary. Usually, good roentgenograms are necessary for diagnosis.

If the bone about a pulpless tooth is identical to that about the neighboring normal teeth, there is no reason to question the health of that tooth. Sometimes, we read about roentgenographically negative teeth being infected. The answer is that either the roentgenogram was deficient or the tooth was contaminated in the process of extraction. Since it is virtually impossible to eliminate all the bacteria in the gingival crevice and underlying bone prior to extraction, tests made of the periapical area by the extraction method are never reliable. Recently, Kesel[10] and his associates at the University of Illinois demonstrated that accurate data can be obtained by carefully controlled root-resection, and that good roentgenograms are an index to the conditions found.

Essentials for Successful Root-Canal Therapy

While we are naturally interested in eradicating infection, the primary interest is in preventing it. In all operations relative to the dental pulp, we must maintain a degree of cleanliness not ordinarily required in other procedures. "Surgical cleanliness" is difficult to attain in the average dental office, where miscellaneous tasks are performed, as compared with the hospital operating room, where every effort in directed to that end. This is probably the chief reason for the failures in root-canal surgery, and dentists who intend to do this work must organize their offices for it.

Another cause of failure is the injudicious use of drugs. It seems that certain dentists, realizing that their procedures lack the requisite cleanliness, have applied powerful germicides to root canals with a view to destroying bacteria which they may have introduced. Such drugs have frequently damaged the apical tissues irreparably, abscess formation resulting. A thorough knowledge of the action of the drugs used is unquestionably essential here.

Undue trauma has likewise caused the loss of many teeth. Working under local anesthesia, we may easily traumatize the periapical tissues unless we know the exact length of the tooth and are governed accordingly. Methods for calculating the extent of root canals have been available for a number of years, and any one undertaking operations of this kind should be familiar with them. I have discussed these points in previous papers,[11, 12] and others have stressed them, but they bear repetition because of their importance. As Coolidge[13] has so aptly said, "The life of a tooth depends upon the vitality and integrity of the periodontal tissues and not the pulp after it has fully developed."

9. Simpson, C. O.: Discrimination in Status of Pulpless Teeth. J.A.D.A., 27:525, April 1940.

10. Kesel, R. G.: Bacteriologic Aspect of Root-Canal Therapy. To be published.

11. Jasper, E. A.: Conservation of Pulp Involved Teeth. J.A.DA., 23:1895-1904, October 1936.

12. Jasper, E. A.: Adaptation and Tissue Tolerance of Silver Root Canal Fillings. J. D. Res., 20:355-360, August 1941.

13. Coolidge, E. D.: Clinical Pathology and Treatment of Dental Pulp and Periodontal Tissues. Philadelphia: Lea & Febiger, 1939, p. 75.

FUNCTION VERSUS NUTRITION AS A CONTROLLING FACTOR IN DENTAL HEALTH: AN ANTHROPOLOGIC SURVEY*

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The masticatory apparatus of modern man is undergoing a series of retrogressive changes. Dental caries is so rampant that 98 per cent of the school children in civilized communities suffer its ravages. Periodontal disease is constantly on the increase, and the number of cases of underdevelopment of the jaws and irregularity of the teeth is assuming alarming proportions. Our previous studies[1] have tended to show that ancient, prehistoric and primitive peoples suffered but little from these ailments afflicting our civilized races.

Sir Arthur Keith[2] aptly presents these fundamental differences between ancient and modern man:

When we come to analyse the characters which distinguish the people of the Neolithic period from the present population of Britain, we see that the changes affect, in the first place, the teeth, jaws, and face. Among modern Kentish folk, as is the case all over modern Britain, there is a tendency to crowding and irregularities of the teeth; the palate and jaws do not grow and expand sufficiently in youth to give room for a symmetrical eruption of the teeth. There is a decided tendency to a narrowing and elongation of the face—a tendency to produce a face of a hatchet-shaped pattern. The nose is narrow and the palate contracted, and its vault is high. The teeth are not worn down as in Neolithic men; they are very liable to be attacked by caries. The front teeth, when the jaws are closed, do not meet edge to edge as in primitive races; like the blades of scissors, they overlap, the lower passing behind the upper. In the Neolithic people all these modern characters are absent. Abscesses or gumboils at the roots of the deeply ground teeth, however, were common; but there is not a single carious tooth to be seen in the Coldrun collection. The teeth are regular in their arrangement, the palates well formed but in actual size the teeth possess the same dimensions as those in modern English people.

The marked disintegrative changes in the masticatory organs and face of modern man that accompany civilization constitute a problem of major significance. It is no longer a matter of one or more dental diseases that we are to contend with. Instead, we are confronted with a degeneration of the entire masticatory apparatus. What is the basic cause of these degenerative changes? Why is it that modern man, who is steadily progressing physically and culturally, should be regressing so far as his dental system is concerned? Is faulty nutrition the primary cause, or is lack of function of the masticatory organs the determining factor? It is my object to discuss this problem in the light of some of our anthropologic studies.

Nutrition and Dental Health

Never before in the history of dentistry has the attention been so firmly focused on nutrition. Many researchers tend to ascribe dental degeneration to

*From the Dental Division, Medical Department, Workmen's Circle.

1. Klatsky, Meyer: Comparative Analysis of Masticatory Function and Its Relation to Dental Diseases in Ancient and in Modern Man. J.A.D.A. 24:932, June 1937.

2. Keith, Arthur: Antiquity of Man, Vol. 1, p. 12.

certain faults in modern civilized diet. Deficiencies or improper balance of calcium, phosphorus or fluorine are suggested by some. Lack of vitamins is blamed by others. It is noteworthy that while this subject is still in the investigative stages, and although there is general disagreement as to the particular factors in diet responsible for dental ills, teachers of preventive dentistry tend to deal with the subject dogmatically. A reenforced diet, it is asserted, will build strong jaws with teeth in proper alinement. The addition of certain vitamins will prevent caries, periodontoclasia and gingival infection. Nutrition is presented as a panacea, taking precedence over all other measures in the prevention of dental diseases. This advocacy of change of diet in the prophylaxis of dental ills is assuming undue and exaggerated proportions. Several students of dental problems have commented on this situation. In his inaugural remarks before the Twenty-First General Meeting of the International Association for Dental Research, the incoming president, Philip Jay,[3] called attention to many misleading statements in current dental literature concerning the role of nutrition in caries control.

Irwin and Wilson[4] have recently published a booklet entitled "An Evaluation of Dental Health Literature," criticizing the quality of much of the dental health literature. A goodly number of the "fallacious," "controversial," "misleading," "contradictory," "impractical" or "overtechnical" statements under criticism here concern the role of nutrition in dental health.

After a thorough examination of the relation of "Dental Caries and the Metabolism of Calcium," Hamilton B. G. Robinson[5] comes to the following conclusion: "Increased calcium and vitamin D intake has not controlled dental caries, and there is no physiologic basis for assuming that it will. . . . The so-called optimal diet is to be recommended for general health, but not as a caries preventive." Thompson,[6] an authority on nutrition, says of the relationship between caries and nutritional factors: "When we find a disease which affects rich and poor alike, with no social gradient of incidence, we are entitled to suspect that the minerals and vitamins we know have little to do with this disease."

Marshall Day[7] investigated oral conditions in the famine district of Nissar, India, and found that:

> Despite the known specific dietary deficiencies which existed during the period of calcification of the teeth, the whole group of 314 children showed an average of only 0.62 cavities per child; 74.20 per cent were entirely caries-free and 83.76 per cent had no cavities in the permanent teeth; and not one cavity was found in the upper or lower incisor teeth. . . . So far as the caries process is concerned, the teeth do not appear to share in the general bodily deterioration consequent upon dietary deficiency. Evidence is advanced that, from the viewpoint of biologic value and its influence on metabolic processes, the quality of the diet is not the deciding factor in caries immunity or susceptibility.

Bunting[8] states: "To hold out to the public the hope that adoption of an adequate diet, irrespective of its sugar content, will prevent dental caries is cruel and unwarranted and serves only

3. Jay, Philip: J. D. Res. 22:194, June 1943.

4. Irwin, V. D., and Wilson, N. W.: Evaluation of Dental Health Literature. St. Paul: Bruce Publishing Co., 1942.

5. Robinson, H. B. G.: Dental Caries and Metabolism of Calcium. J.A.D.A. 30:357, March 1943.

6. Thompson, D. L.: Twelve Principles of Nutrition. New York J. Dent. 13:225, June-July 1943.

7. Day, M. C. D.: Oral Conditions In Famine District of Hissar. J.A.D.A. 31:52, January 1, 1944.

8. Bunting, R. W.: Planning for Postwar Dentistry. J.A.D.A. 30:1659, November 1, 1943.

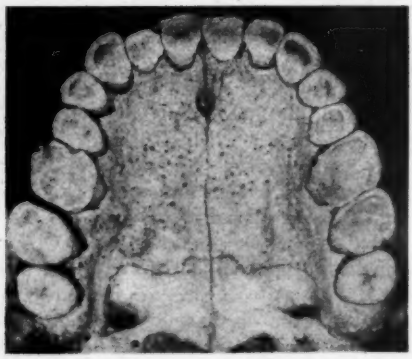

Fig. 1.—Upper dental arch, of Eskimo, with full complement of teeth. (All illustrations courtesy of American Museum of Natural History, New York.)

Fig. 2.—Lower jaw and healthy teeth of female Eskimo.

to discredit the profession that advances it."

The opinions expressed in the foregoing statements presage a generalized reversal of thought, at least as far as caries is concerned. Authoritative opinion veers more and more to the view that we have no proof of a positive relation between this disease and nutrition. But caries is not the only disease that we are concerned with: we are also interested in other oral abnormalities which, together with tooth decay, have led to retrogressive changes in the masticatory apparatus. The nature of the subject is such that it must be considered from an anthropologic as well as a nutritional aspect. It will be relevant, therefore, to examine briefly the work of Weston A. Price, who, for many years, has upheld the theory that dental degeneration is caused by nutritional deficiencies.

Price is an investigator, researcher and traveler. He has visited many countries and communities inhabited by different ethnic stocks, civilized as well as primitive. He has reported his findings in his many contributions to dental literature, which have culminated in the publication of his book entitled "Nutrition and Physical Degeneration." In this book, and in his other works, Price attempts to solve the problems of dental degeneration on the basis of faulty nutrition. He advances the theory that food as prepared and consumed by civilized people is of inferior grade, lacking in calcium and phosphorus and the fat-soluble vitamins. In one of his latest articles, Price[9] emphasizes the deficiency of our food in an unknown nutritive factor, "activator X," which "plays an important rôle in such vital processes as the control of dental caries and the healing of fractured bone." Why do our modern foods lack those "factors" or "activators"? First, "because of the depletion of the minerals of the soil"[10]; secondly, because of our poor choice of, and improper methods of preparing, food.

Price's apprehension over the "depletion of the minerals of the soil" is both antiquated and groundless. The science editor of the *New York Times,* Waldemar Kaempffert, in the May 9, 1943 issue, calls attention to a book published as far back as the first century A. D. by

9. Price, W. A.: Role of New Vitamin-Like Activator in Control of Dental Caries. J.A.D.A. 30:888, June 1, 1943.

10. Price, W. A.: Nutrition and Physical Degeneration. New York: Paul B. Hoeber, Inc., 1939, p. 392.

one Lucius Junius Moderatus Columella, who wrote:

> Again and again I hear leading men of our State condemning now the unfruitfulness of the soil, now the inclemency of the climate for some seasons past, as harmful to crops; and some I hear reconciling the aforesaid complaints, as if on well-founded reasoning, on the ground that, in their opinion the soil was worn out and exhausted by the overproduction of earlier days and can no longer furnish substance to mortals with its old-time benevolence. . . . Such reasons . . . I am convinced are far from the truth.

So we see that, 2,000 years ago, people already had great misgivings about the depletion of the soil. These fears are based more on speculative fancy than on scientific fact.

As to the second statement, that much of the food value is lost by poor choice and inadequate methods of preparing food, a great deal of progress has been made of late to remedy this condition. Our increased knowledge of the role of the inorganic elements and vitamins in nutrition makes us conscious of their importance. We know how to preserve them in cooking and processing food. Our diet is also supplemented by the large consumption of vitamin concentrates; but, in spite of all this, we discern no notable improvement in the condition of the teeth and other masticatory organs.

Another important point for us to consider is that, if the masticatory apparatus suffers because of diet deficiencies, these deficiencies should have a deleterious effect on other organs and tissues of the human organism. If lack of inorganic salts and vitamins in the diet causes dental degeneration, it should also effect notable disintegrative changes in the rest of the body. One would expect, then, to find modern man a physical degenerate as compared to ancient or primitive man. Indeed, Price beguiles himself into the belief that such is really the case. He speaks regretfully about the decadence of civilized man, on the one hand, and, on the other, he admires the "accumulated wisdom" of the isolated primitive tribes who live on natural, rich foods, which contribute greatly to their physical superiority.

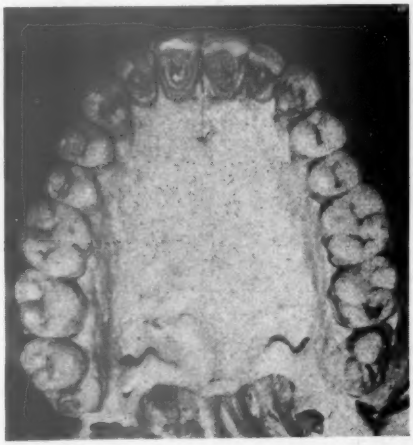

Fig. 3.—Upper dental arch of Hindu.

Fig. 4.—Lower jaw of Hindu. The Hindus are the most undernourished people in the world, yet their masticatory apparatus is in better condition than that of the average Europeans.

Is there any scientific basis for the contention that the general physical state of the primitive is superior to that

Fig. 5.—Skull La Chapelle aux Saints. This prehistoric man had massive jaws and good teeth.

of advanced man? Let us examine the facts in anthropologic perspective.

Primitive and Advanced Peoples: A Comparison

Note of the poor state of the masticatory apparatus of civilized man leads many well-meaning observers to the mistaken conclusion that all of modern man is degenerating. These students do not realize that the underdevelopment of the masticatory organs and their great susceptibility to disease is an aberrant condition, confined entirely to this part of the body; that this condition is caused by lack of function of these organs, as we shall see further on.

Scientific study tends to show that, irrespective of his dental organs, modern man has all the marks of physical superiority to ancient and primitive people. Furthermore, this physical superiority of civilized man is brought about by favorable environmental conditions, among which better nutrition plays a prominent part.

In attempting to compare the physiques of modern, civilized peoples with those of ancient or contemporary primitive races, there are four important factors to be considered: (1) organic development, (2) stature, (3) disease susceptibility and (4) longevity.

1. *Organic Development.*—The skeletal structure and general organic development of the average civilized man is far superior to that of the primitive. This fact is brought out clearly by E. A. Hooton, of Harvard. In his notable book "Why Men Behave Like Apes," Hooton first takes a somber view of the state of the masticatory apparatus and face of civilized man. He then points out that there is a reversed condition when we attempt to compare the other parts of the human organism of modern with primitive man. Because of their universal relevance, his remarks merit quotation at length[11]:

Small, malformed jaws, with the teeth

Fig. 6.—Skull of Ober Cassel man showing broad face and rugged condition of masticatory apparatus.

11. Hooton, E. A.: Why Men Behave Like Apes and Vice Versa. Princeton University Press, 1940, pp. 91-94.

crookedly aligned, and feeble muscular attachments; high, narrow palates, with roofs like a Gothic vault; asymmetry of the nasal skeleton, with pronounced skewing of the septum and enlargement of the turbinates on one side—these are the hall-marks of civilization. . . .

However, by no means all of the skeletal differentiae between men in a state of nature and those of a condition of artifice are to the biological advantage of the savage. Except in the cases of individuals obviously affected by pathologies other than these of the mouth, nose, and teeth, skeletal structure is commonly heavier and more robust in the civilized man than in the savage. . . . The joints and shafts on the long bones of civilized man are commonly larger and heavier than those of the savage of the same racial stock. Usually, and almost invariably, if the civilized person has been a manual laborer, the muscular markings of the arm bones are much more prominent than in savages. Especially, the bones of the forearm show high evolutionary differentiation and better muscularity. There is often evidence of increasing mobility. The hand and wrist bones of the civilized person are larger and the articular facets and surfaces are more clearly cut. . . . The osteological job appears to have been done with more certainty as to pattern and more definition of form and finish. These features of the upper extremity of civilized man may be attributed plausibly to the fact that civilization is based upon nearly unintermittent manual labor; the savage, while not at all inactive, does far less work with his hands, and that is one reason why he does not build a civilization. He is a gentleman. I have the impression, although no statistical proof, that handedness, as indicated by greater size and superior muscularity of the preferred member, is exaggerated in the civilized as contrasted with the uncivilized man. . . . The increased robustness and stability of structure which often manifests itself in the upper extremity of civilized men is even more pronounced in the pelvic girdle and in the bones of the legs and feet.

Fig. 7.—Skull of Grimaldi negroid youth. This prehistoric youth had well-developed masticatory organs and good teeth.

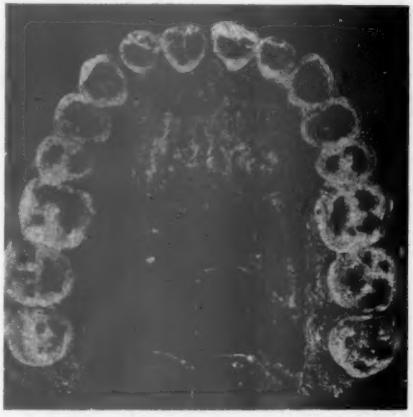

Fig. 8—Upper dental arch of Predmost man (anterior view). Deep attrition of the teeth bespeaks a well-functioning masticatory apparatus characteristic of primitive people.

This is a very clear and authoritative view on the subject, and no further comment is necessary.

2. *Stature.*—The better state of development of civilized man is reflected fur-

ther in his evident superiority in stature. Human beings are classified as to their stature into tall, medium and short. While men and women of various body heights are well represented among the main groupings of mankind, it is well known that the average modern man is much taller than the average man of the past or contemporary primitive groups.

Until recently, the average stature of modern, civilized man was estimated at 67 inches. During the First World War, the average stature of the millions of men who were examined for recruitment into the U. S. Army was 67½ inches. During the present war, it has increased to 68 inches. We can readily accept the latest figure as a standard for modern man. Unfortunately, we have no exact data on the average height of primitive man as a group. However, we do know that the mean stature of one of the tallest of primitive peoples, namely that of the true Negro of Africa, does not exceed this figure of 68 inches. Of the indigenous races of Africa, besides the true Negro, the average height of the Bantu is 65¾ inches; that of the Bushman is 60 inches, and the mean stature of the Negrito, or Pygmy, people is 57 inches for the male and only 54 inches for the female. An overwhelming majority of other primitive tribes, including the Eskimo with the best developed masticatory apparatus and healthiest teeth, are much shorter than the average civilized man.

Measurements of skeletal collections of ancient and prehistoric ethnic stocks also reveal a greater predominance of the shorter types. The stature of *Pithecanthropus* is estimated at 67 inches; Spy I, 64 inches; Spy II, 63 inches; La Chapelle, 63 inches; Grimaldi (negroid), 61 inches; Aurignac, 63 inches; Chancelade, 59 inches; Grimaldi, 73½ inches, and Cro-Magnon, 72 inches. With the exception of the last two types, they are all shorter than modern man. As these figures are based in most cases on finds of single skeletons or parts of skeletons, this does not indicate the average for those types. One of the prehistoric races best known to us is the Neanderthal man with his sturdy jaws and good teeth. Measurements of about 100 skeletons discovered so far indicate an average stature of only 63 inches for the men of that race. The stature of the Proto-Egyptians, who lived at the dawn of history, was only about 1 inch greater than that of the Neanderthal man, that is 64 inches.

While stature is a racial characteristic depending mainly on heredity, it is known that body height is also greatly influenced by environmental conditions prevailing during the period of growth, in which nutrition plays a prominent part. Children brought up in richer families tend usually to greater stature than those from impoverished surroundings, since the former are better fed than the latter. Heiser[12] tells us of nutritional experiments performed on Japanese children. An increase in height and weight was produced in a group by feeding them the diet of taller races.

We are all familiar with the experiments performed at Harvard, where measurements of a number of students were taken and compared with those of their own fathers who attended the college. The difference in favor of the younger generation for those who may be considered to have completed their growth was about 4 cm. A similar condition prevails in England, where it was found that school children are 2 inches taller and 8 pounds heavier than those of a generation ago.

It is generally agreed that a better selection of food and a more varied diet is largely responsible for this increase in stature of modern civilized people. This runs directly counter to the view held by those who contend that modern diet

12. Heiser, Victor: You're the Doctor. New York: W. W. Norton and Co., 1939, p. 80.

is inferior to that of the primitive, and that nutritional factors play an important role in dental degeneration.

3. *Disease Susceptibility.*—Mankind has been heir to disease since time immemorial. Plague and pestilence were prevalent in ancient times as well as in the Middle Ages. Epidemics of scarlet fever, diphtheria, whoopingcough, measles, typhoid, cholera and dysentery have been claiming millions of victims among the helpless infants and children of past generations. Tuberculosis, which affects young and old alike, still holds a firm grip on millions all over the world, and still kills more people among the primitive races than does any other disease.

With the advent of civilization, many diseases have been brought under control. Some of these diseases have been checked and others completely wiped out. Modern medicine has brought us many curative, prophylactic and hygienic methods of combating disease. Noteworthy among these methods is a properly balanced and more scientifically prepared diet, which contributes greatly to building a stronger, healthier and more resistant body. Thanks to our better knowledge of food and nutrition, we suffer but little from diet deficiency diseases. Information about the vitamins was instrumental in the banishment of most of the vitamin-deficiency diseases from civilized communities. Beriberi, rickets, scurvy, xerophthalmia and pellagra, diseases that claimed so many victims in the past, are hardly known to modern man. Consequently, civilized people suffer less from certain diseases now than did ancient and primitive people. The shift has been toward the diseases that accompany old age: cancer, heart disease, diabetes, hypertension, apoplexy, kidney disease and hardening of the arteries. Speaking of cancer, Fishbein[13] says:

> If the savages do not perish of cancer, the reason is that they do not live long enough to die of this disease. Cancer is essentially a disease of advanced years. Civilized man has a life expectancy at birth of 60 years; the savage has a life expectancy at birth of about 35 years. More than 90 per cent of the people who die of cancer are over 45 years of age. Obviously when the savages cease to die from infectious diseases and similar conditions which used to carry off civilized man, and live longer, they too will have their proportion of deaths from cancer, whether they eat white bread or whole wheat bread.

What is true of cancer is also true of the other diseases that accompany old age. This leads us to a consideration of the fourth factor in comparing modern man with the ancients.

4. *Longevity.*—There may still exist the erroneous impression that ancient man had a longer life span than modern man. This is due to a literal acceptance of Biblical statements, such as that Methuselah lived 969 years, Adam 930 and Seth 912 years. While it is impossible to verify the span of life of people who lived many thousands of years ago, scientific investigators agree that it was impossible for any human being ever to have reached an age close to 1,000 years. In truth, the Biblical statement referred to lunar years or months, and not to actual years. The ripe old age reached by Methuselah, Adam and Seth was less than the age reached by some individual centenarians recorded in history, or presently known to us; and it was only a little higher than the average life span of modern man. The average span of life of civilized man has doubled since the last century, and it is constantly increasing. At present, it is in the neighborhood of 64 years. The average span of life of contemporary primitive people is only 35 years. The average life span of the Eskimo, whose teeth are immune to caries as long as he remains isolated from civilization, is estimated at no more than 20 years.

13. Fishbein, Morris: Your Diet and Your Health. New York: McGraw-Hill Book Co., 1937, p. 35.

Civilized man lives longer not only because of the conquest of disease, but also because of his stronger constitution and his better developed organs and more resistant body. He lives under better environmental conditions and is better fed and better nourished than primitive man. The modern scientifically selected diet of civilized man is better than the one consumed by primitive man. This contributes greatly to his superior physical state, and certainly does not reflect a serious lack of vitamins or any other nutritional factors, to which dental degeneration might be attributed.

Use and Disuse of the Masticatory Apparatus

In view of the general physical superiority of civilized over primitive mankind, we must now explain the degenerate state of the masticatory apparatus of modern man. Here, the role of proper function of these organs appears to be paramount.

The normal employment and proper use of an organ stimulates it to normal growth and development. On the other hand, improper function or incomplete use of an organ tends to stunt its growth and development. Lamarck stated this concept concisely in his third law: "The development of organs and their force of action are constantly in ratio to the employment of these organs."

Hooton, as we have seen, attributes the better skeletal structure of modern man to the greater employment and better use of his organs. The order is reversed as far as the masticatory apparatus is concerned. Here, it is the savage who uses his chewing organs more and to greater advantage than civilized man.

We must now consider the main factors in civilized life that contribute to the dysfunction of the masticatory organs. These are:

1. Physical consistency of food. That the physical state of the food consumed plays an important role in the degree of function of the masticatory organs was forcefully brought to our attention forty years ago by Sim Wallace. In his booklet "The Physiology of Mastication,"[14] he vividly describes the processes of mastication and deglutition, showing the great difference in these processes when hard, bulky and fibrous foods are eaten, or when liquid, soft or semisoft foods are consumed. The former foods require forceful chewing which, in turn, stimulates the masticatory muscles to greater activity.

Realization of the significance of this subject impelled us to a further study of the processes of mastication and deglutition. By means of fluoroscopy, we were able to observe these processes from the moment food is taken into the mouth until it is swallowed. Fluoroscopy had the great disadvantage of repeated exposure to the x-rays for a long time. To obviate this, and to permit leisurely study, we decided to resort to cine-fluorography.[15] We made a motion picture record of the images seen on the fluoroscopic screen and were thus able to study the chewing of different kinds of foods by different individuals. We experimented with the following foods: milk, soft bread, raw orange, hard bread, celery, steak and hard corn. The film demonstrates the different reactions of the internal organs of the head and neck to these foods. Action of the masticatory organs is faint and feeble when liquid or semiliquid foods are eaten. It is constantly enhanced with the harder and more resistant foods. Such foods as hard bread, celery and steak stimulate the masticatory organs to the greatest activity. By observing the film, we can study

14. Wallace, J. Sim: Physiology of Mastication and Kindred Studies. London: J. & A. Churchill, Ltd., 1903.

15. Klatsky, Meyer: Cinefluorographic Study of Human Masticatory Apparatus in Function. A. J. Orthodontics, 26:664, July 1940.

the physiology of mastication in its active stages: the swinging movements of the mandible and the strong action of the masticatory muscles, the strenuous action of the teeth in incising and then chewing the coarse, resistant food. We can also note the swift changes which take place in the temporomandibular joint, and the action of the tongue in tossing the food about, directing it to the occlusal surfaces of the teeth, then to the pharynx for swallowing. We see a great deal of dynamic activity and movement, a harmonious combination of living organs and tissues in a constant state of action.

The intensive physiologic activity of the masticatory organs brought about by the consumption of stimulating foods tends to enhance healthy growth and development of these organs. The sturdiness of the jaw bones, the vigor of the masticatory muscles and the health of the teeth of the primitives can be traced directly to greater function of the masticatory organs brought about by the consumption of hard, fibrous, bulky and resistant foods. Civilized man, on the other hand, uses few stimulating foods, his diet consisting mainly of liquids or semisolids. The foods are processed, cooked, meshed and milled into a soft, nonresistant state. This leads to the disuse of the masticatory organs; hence, the deplorable state of their health and development.

2. Food habits and table manners. The radical change from stimulating to nonstimulating foods can be ascribed directly to our civilized mode of living. The life of hustle and bustle, the constant pursuit of time-saving devices, has led to the simplification and sophistication of food habits. We have neither the time nor the patience for a wholesome meal that requires much time for chewing. We have applied all our ingenuity to substituting soft and liquid foods for tough and bulky foods. Without realizing its harmful effect on the chewing organs, we have relegated pleasurable mastication to the background. In our daily food consumption, the emphasis is on nutrition and not on mastication. For many years, dietitians have been stressing only the importance of the calories, the significance of the inorganic elements and the role of the vitamins. Eating soft and liquid food has become a custom and habit. We have created a special code of so-called table manners. Father and mother feel it their parental duty to instil refined and graceful eating manners in their children. Food must be chewed gently and imperceptibly. Wide opening of the mouth, forceful chewing, lip smacking are bad style; hence, they are tabooed. Table manners, which are the direct outgrowth of our rushing civilization, were unknown to primitive people. Our manners and ethics not only differ from those of the savage, but, in many cases, they are also in direct conflict with them, as Boas[16] points out: "To smack one's lips is considered bad style, and may excite feelings of disgust; while among some Indian tribes it would be considered bad taste not to smack one's lips when invited to dinner, because it would suggest that the guest does not enjoy his meal." It is far from our intention here to decide this ethical issue in favor of the savage Indian or the advanced modern. We wish only to point out that, as far as the health and development of the masticatory organs is concerned, Nature is on the side of the primitive because of his habits of using and exercising his organs of mastication.

3. Artificial stimulation. Another important factor which is indirectly responsible for the neglect of the masticatory apparatus is the lack of artificial stimulation. The muscles of mastication are not exercised artificially as are all the other muscles of the body. Civilized people are conscious of the role that physical exercise plays in the health and development of the human body. This is

16. Boas, Franz: Mind of Primitive Man. New York: Macmillan Co., 1938, p. 229.

the main reason that gymnastics, acrobatics and all kinds of athletic sports are so popular. Baseball, football, handball, soccer, boxing, wrestling, walking, jumping and swimming are promoted, not only for recreational enjoyment, but also because they provide good exercise for the body organs. Medical men recommend various kinds of gymnastics for the maintenance of health and vigor, also for the correction of certain organic defects. Physical culturists recommend special sets of exercises to provide stimulation to the muscles of the arms, hands, legs, feet, toes, neck, shoulders, lungs, etc. Not a muscle in the human body is overlooked. Unfortunately, exercise for the muscles of mastication is not provided by any of the gymnastics, calisthenics or athletic sports that we indulge in. The masticatory organs are in greater need of artificial stimulation than any of the other bodily organs because they are not employed sufficiently in the act of food chewing; and yet they are the most frequently neglected by the public and overlooked by the medical man. Lack of muscular exercise is the controlling factor in the degenerative changes of the masticatory apparatus that we have been observing of late. It is responsible for the underdevelopment of the jaws and malalinement of the teeth; also for an unhygienic condition of the mouth, which predisposes the teeth to rampant caries and periodontal disease. It has been suggested that chewing gum provides beneficial stimulation to the musculature of the mouth, but the uncontrolled use of such products is subject to serious objection from the standpoint of oral and general health. It falls upon the shoulders of the dental profession to remedy this situation.

Summary and Conclusion

1. The masticatory apparatus of modern man is of greatly inferior development, and his teeth and periodontal tissues are more susceptible to disease than those of ancient and primitive people.

2. The tendency among many investigators to ascribe these degenerative changes to nutritional factors and diet deficiencies has no scientific basis.

3. If faulty nutrition played an important role in dental degeneration, it would also have an adverse influence on the human organism as a whole.

4. An anthropologic survey shows that civilized man is physically far superior to man of the past and to contemporary primitive races. His general build, his skeletal structure, his organic development and his average stature transcend those of the primitive. He is more resistant to disease and has a greater span of life than the primitive.

5. Better food and better nutrition play an important part in this evident physical superiority of civilized man.

6. Changes in diet and the addition of vitamins or inorganic salts will not radically affect the disintegrative changes in the masticatory organs, and will not solve the problem of dental degeneration.

7. Use and employment of organs play an important part in the development and maintenance of health of these organs.

8. The organs of mastication of civilized people are neglected and inadequately used owing to the physical nature of the food we eat.

9. Soft and liquid foods do not offer sufficient exercise to the muscles of mastication and the teeth.

10. Civilized manners and habits contribute greatly to the inactive and dormant condition of the masticatory apparatus.

11. The masticatory organs are not stimulated by artificial means as are all the other organs of the body.

12. The restoration of function to the masticatory apparatus is the greatest problem confronting the dental profession at the present moment.

401 Broadway.

CORRECTION OF A CASE OF CICATRICIAL ORAL ATRESIA

Adolph Berger, D.D.S., New York, N. Y.

The literature on cheiloplasty, atresia of the mouth and the correction of deformities following injuries and burns is quite extensive and dates back several centuries.[1-4]

In reporting this case, it would serve little purpose to present a review of the literature extant. A record of some of the articles on cases analogous to the one presented here is appended as merely a partial bibliography.

The outstanding feature of the method used in this case was the utilization of the indigenous mucous membrane for epithelization of the affected areas. An altogether satisfactory esthetic and functional result was obtained in a case of cicatricial atresia of the mouth of over forty years' standing.

Report of Case

History.—A. L., a woman, aged 52, born in Hungary, married for over twenty-five years and with no children, gave a history of scarlet fever at the age of 1, diphtheria at 6 and smallpox at 9. She had enjoyed good health through the years and appeared to be well developed and well nourished.

For the past few years, she had been seeking relief from a cicatricial atresia of the mouth, which had prevailed ever since her childhood days. According to her recollection, during the smallpox episode, her face and lips were extensively ulcerated and contraction of her mouth followed recovery from this ailment.

Although she was unable to open the mouth or use the lips freely during these years, this incapacity did not hamper her in pursuit of a normal life. Through the years, she received considerable dental attention in the way of fillings and small prostheses, which were handled satisfactorily despite the small oral aperture.

In the course of natural events, because of progressive deterioration, a point had been reached where all of the upper teeth had to be removed and only a few of the lower ones could be retained. This more recent problem was not a purely cosmetic one, but was essentially functional. With the contracted oral aperture, no impressions could be taken for dentures, nor could dentures fitting the jaws be passed through the existing orifice.

Examination.—It was found that, through the medial part, the vermilion borders of both lips were nearly normal in outline. The tissues were fairly flexible, but could not be stretched because of radiating unyielding cicatricial fibers at different points. The corners were held together through a depth of about half an inch by firm and unyielding cicatricial bands. The area could probably be best compared to the footwebs of water fowl. (Fig. 1.)

All the lip surfaces were nevertheless epithelized, although, throughout, the epithelial layer appeared to be very thin indeed. The inner surface of the upper lip presented a number of scars and the frenum was bulky, thickened and unyielding.

1. Hart, C. A.: Case of Excessive Contraction of Mouth Following Scarlet Fever; Relieved by New Operation. New York M. J., 5:499-503, 1867.
2. Gaston, J. McF.: Cicatricial Stenosis of Mouth. Internat. Clin., 4:234-237, 1897.
3. Kazanjian, V. H.: Plastic Surgery of Lip. J.A.M.A., 77:1959, December 17, 1921.
4. Hunt, H. L.: Plastic Surgery of the Head, Face and Neck. Philadelphia: Lea & Febiger, 1926, pp. 354-355.

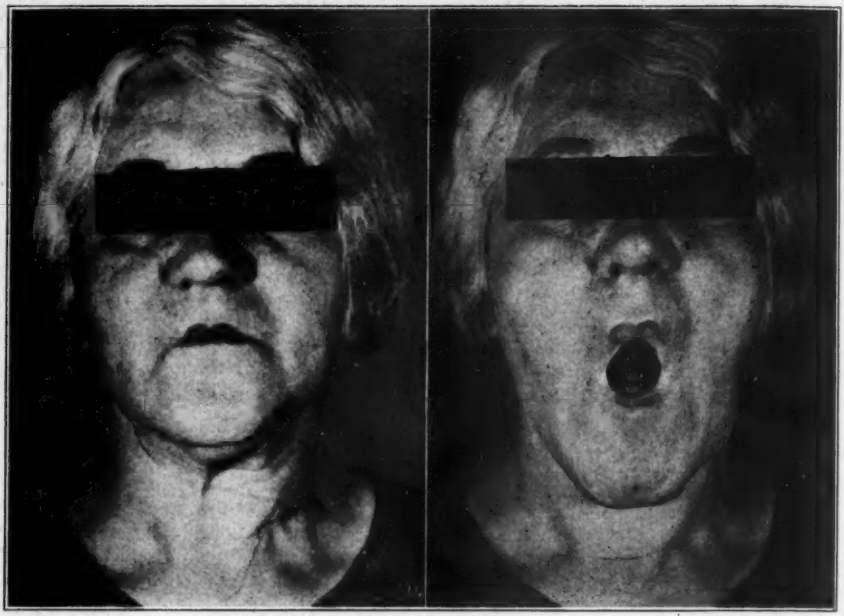

Fig. 1.—Left: Original condition with lips closed. The cicatricial webbing extended as shown in Figure 1, from the outline of the vermilion border to the corners of the mouth. Right: Full opening of orifice at this stage with tension about entire circumference.

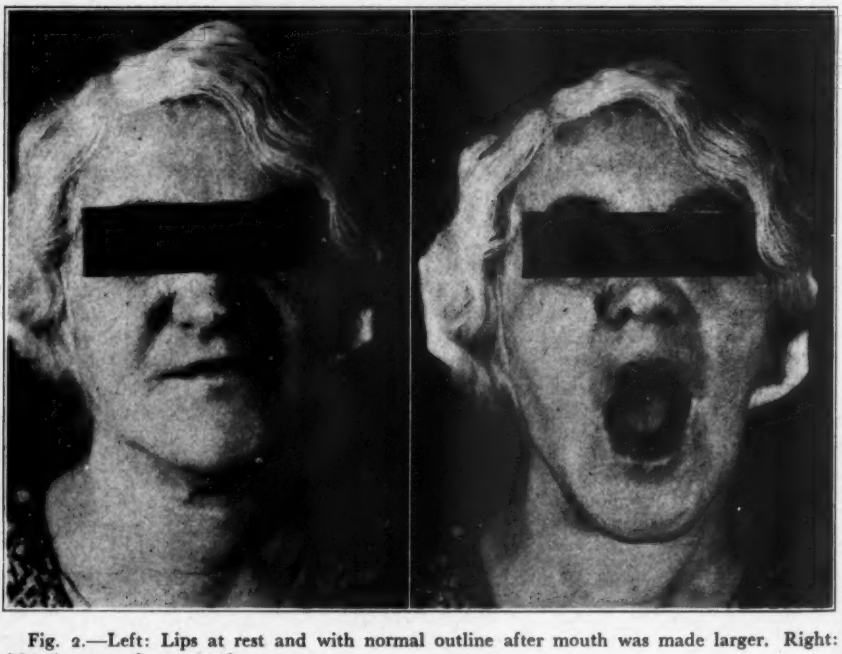

Fig. 2.—Left: Lips at rest and with normal outline after mouth was made larger. Right: Mouth open after operation.

The abnormality was carefully studied with the object of operating to obtain a satisfactory esthetic and a good functional condition. It was evident that enlargement of the oral orifice alone would not afford the relief sought. To obtain optimum function, it was necessary to restore the flexibility and elasticity of the orbicularis oris muscle. To attain this, the cicatricial tissues would have to be removed while muscle fibers were completely preserved. Furthermore, it was essential to prevent or, so far as this was possible, reduce postoperative cicatricial tissue formation to the minimum.

The plan of operation decided upon was to utilize the indigenous mucous membrane without resorting to sliding flaps or skin grafts. In a sense, the utilization of the local mucous membrane was experimental as, in most instances reported, various skin grafts or sliding flaps have been used. It also seemed that, by performing the operations sectionally, the postoperative cicatrix and its contraction would be reduced.

The procedure was planned with the following steps: (1) peeling back or rather raising the mucous membrane; (2) excising the cicatricial bands to the muscle fibers, and (3) covering these raw surfaces with the raised mucous membrane.

Operations.—The two commissures were first operated on. Infiltration anesthesia of 2 per cent procaine with suprarenin was used. The injections were made in the deeper parts of the muscle so as not to alter the surface relationships by bloating or distorting. The incisions were made over an area of about 1½ inches and about 2 or 3 mm. from the skin and mucous membrane junction. The thin, parchment-like mucous membrane was divided. With a fine elevator, this thin tissue was raised with the least amount of trauma. The cicatricial bands were excised through the extent of the incision until the muscle fibers of the orbicularis oris were brought into view. Severing of the muscle fibers, which, on testing, permitted considerable stretching, was carefully avoided. With the removal of the cicatricial tissue, there was more mucosa than necessary to cover the denuded surfaces. This tissue was fitted snugly over the area, slightly overlapping (about 1 mm.) the outer apposing edge and sutured into position with interrupted horsehair sutures. The wound healed by first intention and, after three days, the sutures were removed.

Fig. 3.—Dentures shown in mouth. The broad smile shows the flexibility of the lips and their complete control, especially at the corners.

With these two operations performed at the first session, the corners of the mouth were reconstructed and were extended to their normal position. Despite this enlargement, there was little improvement in opening the mouth because of the inelastic bands in the remaining portions of the lips.

Again to prevent secondary contraction, the remaining parts of the lips were operated on in three different sessions. In a similar manner, the mucosa was incised over the summit of the line of tension and peeled back. This tissue was even thinner over the

more fleshy parts of the lips, and the utmost care had to be exercised to avoid tearing or laceration. Throughout, the vermilion borders of both lips were preserved. After removal of the sutures, moderate finger traction was applied to both lips, stretching the tissues and breaking up the immediate adhesions.

Outcome.—About three months after the first operation, the aperture was large enough to permit insertion of a suitable impression tray. (Fig. 2.) A full upper and a partial lower denture were constructed. These the patient is wearing with a great deal of satisfaction. (Fig. 3.)

It is noteworthy that, with function, the lips have grown to be more flexible and more elastic. The psychologic effect was that, with normal function, the patient has grown more cheerful. Elimination of a number of dental infections and better masticatory function appear to be reflected in the improved general health of the patient. Furthermore, there is no dribbling of saliva or excoriation at the corners of the mouth as is the case when control of the orbicularis oris is impaired by slitting across or damaging or removing its more important fibers.

654 Madison Avenue.

THE FOREIGN BODY LOCATOR (BERMAN) IN ORAL SURGERY

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To locate a hypodermic needle broken off in the mouth is always difficult. The breaking usually occurs during the administration of procaine for mandibular nerve block. The constant movement of the muscles of the mandible is very likely to shift the needle from its original position. The avoidance of important vascular structures in the area calls for extreme caution in any attempted surgical procedures. Restriction in movement and vision within the oral cavity, blocked by props to keep the mouth open, adds greatly to the surgeon's difficulties. Approach through an incision in the face is objectionable because of scarring.

The customary procedure of relying solely upon x-ray views taken from several different angles provides a good starting point, but is far from adequate for finding the usually elusive needle. When the needle is embedded in soft tissue, it is difficult to obtain reliable information from palpation, which often serves only to push the sharp pointed needle farther away without offering sufficient resistance for it to be felt by the surgeon's probing fingers.

The Berman metal locator was employed in a difficult case of broken needle in the mandible, after an earlier attempt at removal elsewhere had been fruitless. This was the first known use of the "locator" in oral surgery.

The apparatus resembles a portable radio. Its sensitive electromagnetic probe detects the metallic foreign body from some distance without the necessity for making contact with it. A dial registers the approach of the probe to the foreign body. The point at which the maximum is registered indicates the closest approach to the foreign body and is usually the correct place for making the initial incision. This visual indication is supplemented by a sound of varying pitch produced by a small loud

speaker. The most valuable feature of this apparatus is that its small sterilizable probe may be inserted directly within the wound for reorientation of the foreign body regardless of shifting of its position. The indication of the locator is instantaneous. Frequent reorientation lends precision to the removal procedure, and minimizes trauma. The surgeon has an added feeling of confidence in being able to determine at will the correctness of the route that he is following and is thus better able to decide on the best course. The locator makes palpation, with its attendant dangers, unnecessary. Palpation necessary for checking the position of the internal structures should be limited to the absolute minimum.

The locator is highly sensitive to the magnetic metals (iron and steel), only slightly sensitive to the nonferrous. Thus, a small section of a stainless steel hypodermic needle is readily detected and localized without interference from small gold, silver and other dental fillings that may be present. A platinum hypodermic needle or a needle that is absolutely nonmagnetic will not be detected by this apparatus.

In the following case, the surgical procedure, after the needle was localized, proved simple and required but a few minutes.

Report of Case

Mrs. H. W., aged 37, in good health, seen June 8, 1944, had had a hypodermic needle broken off in the mandible during block anesthesia. X-rays revealed a needle 33 mm. long in a posterior position, horizontal to the occlusal surface of a crowned molar. Through a previous incision, and under partial anesthesia, an unsuccessful attempt was made to locate the needle.

The patient was admitted to the hospital and anesthetized with avertin (tribromethanol) and intratracheal ether. The Berman electric locator was employed. As the pressure of metal mouth props or airways would cause a false reaction to the electric locator, an intratracheal rubber tube was used as the anesthetic instrument and corks were used as mouth props.

The locator was employed on the outside of the face to determine the general position and angulation; i. e., approximate vertical and horizontal position, these positions being marked with gentian violet. The sterile probe was then introduced into the wound and, by careful exploration, the needle was located. Despite the fact that the particular stainless steel composition of the needle made it only weakly magnetic, the locator functioned excellently. A hemostat was introduced into the previously established position. The needle was deeply embedded in the pterygoid muscle. It was a simple matter to draw the needle through the tissue by means of the hemostat. Recovery was uneventful other than some edema, controlled by sulfa therapy and frequent irrigation.

Conclusions

The locator is a distinct aid in the surgical removal of broken intra-oral hypodermic needles. In a great number of cases, there may, of course, be a small percentage that will not be successful because of surgical complication that makes it unwise to proceed. In those cases, as well as in the successful ones, the surgeon will have, through use of the locator, information upon which to make correct decisions.

5 East Fifty-Third Street.

TREATMENT OF PULPLESS TEETH WITH A CONCENTRATED SULFONAMIDE SOLUTION*

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Much of the advancement in medical and dental therapeutics during the last few decades has been based upon chemical progress. It is safe to say that chemical synthesis is far ahead of pharmacologic investigation. While thousands of organic chemicals have been developed during the past twenty years, only a small number have been tried and tested in the pharmacologic laboratory. To test them all would take scores of years. Since a considerable part of medicodental therapeutics, including the surgical, is dependent on the use of drugs and chemicals, the healing arts owe a debt of gratitude to the chemist. This is especially true of the last several years, the era of chemotherapy. With the advent of such antibacterial agents as the sulfonamides and penicillin, some of the infectious diseases that took a heavy toll of life each year, such as pneumonia and meningitis, are no longer dreaded. Even allowing for the fact that the merits of these drugs have been unduly extolled in the eagerness to use and enthusiasm for a new and spectacular agent, they shall have a prominent and useful place in medical and dental therapeutics.

It is only natural that dentistry, in its desire to keep abreast of every new discovery and to bend it to usefulness in its own field, should have turned to the sulfonamides as soon as their properties were made known and the material itself was made available. Reports soon began to appear of the employment of sulfanilamide after operations or tooth extraction, in dry sockets and even for the treatment of pulpless teeth. Since sulfanilamide, as well as the other sulfonamides, is only slightly soluble in aqueous solutions, Adams[1] employed hot water (140 F.) as a vehicle to increase its solubility, forcing the solution through the root canal and out of an artifically created fistula near the root apex. The method has not attained any degree of popularity, probably because of the necessity for creating a fistula and because of the possibility of burning the soft tissues with a hot solution.

With the advent of a 20 per cent microcrystalline suspension, sulfanilamide and sulfathiazole appeared to hold out much promise for the treatment of pulpless teeth. Consequently, through the courtesy of T. N. Harris, some of this material was obtained before it was released for general use and employed in the root therapy clinic of this school for the treatment of pulpless teeth. The sulfonamide suspension was sealed in the root canal after the canal had been cleansed of all débris and had been irrigated. An effort was made to force a drop of the suspension through the apical foramen into the periapical tissue by pumping the material through the apical foramen with an absorbent point.

The "blindfold" method of testing was used in the study in order to rule out personal bias. Two bottles containing the sulfonamide suspensions were labeled A and C, while a control bottle was labeled B. Bottle A contained 20 per

*From the School of Dentistry, University of Pennsylvania.

1. Adams, F. R.: Sulfanilamide and Heat in Root Canal Therapy. D. Items Int., 62: 315, April 1940.

cent sulfanilamide; bottle C, 20 per cent sulfathiazole. The control solution, B, contained equal parts of milk of magnesia and water and simulated the sulfonamide suspensions in appearance. Students in the root therapy clinic were assigned cases in sequence (A, B, C) until sufficient control data were obtained, when only A and C were used. The medicament assigned, whether it was A, B or C, was employed throughout the treatment of the tooth.

It was observed at the beginning of the study that an absorbent point, when dipped in the sulfonamide suspension, absorbed the water, taking little of the sulfonamide suspension with it unless the suspension was allowed to dry out slightly through evaporation of its water content. After about thirty pulpless teeth had been treated in the manner outlined, it was realized that, in some cases, the sulfonamide suspension had a tendency to cake and to clog the root canal. The sulfonamide could be broken apart with a root canal instrument, but this was an undesirable procedure.

It was evident that a concentrated sulfonamide, if it was to be used, would have to be in a solvent that prevented the sulfonamide from caking; i.e., a solution rather than a suspension. After a number of solvents had been considered, ethylene or propylene glycol appeared to be the most promising.

Ethylene glycol, since it was the better solvent, was finally chosen. While it is more toxic than propylene when taken internally, its potential toxicity was considered to be negligible because of the small amount used in the root canal of a tooth. Sulfadiazine, since it was more than twice as soluble in ethylene glycol as sulfathiazole, and since it was also considered to be an effective agent against streptococci, was substituted for sulfathiazole.

Solutions of sulfanilamide and of sulfadiazine were made up in 15 per cent concentrations. These solutions were made by adding the sterile sulfonamide powder to warm ethylene glycol. The sulfonamide solution was clear, while the sulfadiazine solution was opal. In time, the sulfonamide would fall out of solution, but it could be quickly redissolved by shaking the bottle. Ethylene glycol alone was used as a control solu-

Table 1.—Average Number of Treatments Required to Yield Negative Cultures Using a 15 Per Cent Sulfanilamide or 15 Per Cent Sulfadiazine Solution

Total Number of Cases Treated	Diagnosis	Average Number of Treatments with Sulfanilamide*	Sulfadiazine	Both Groups
42	Acute serous pulpitis	4.6	5.0	4.9
8	Acute suppurative pulpitis	3.5	4.5	4.1
13	Chronic ulcerative pulpitis	5.0	4.9	5.0
1	Degeneration of pulp	None	3.0	3.0
28	Necrosis or gangrene of pulp	6.5	7.1	6.8
7	Acute radicular abscess	7.2	6.5	7.0
11	Subacute radicular abscess	6.9	7.6	7.4
22	Chronic radicular abscess	6.4	6.2	6.2
4	Granuloma	6.8	6.9	6.9
16	Intentional extirpation†	2.0	2.1	2.0

*The differences in favor of sulfanilamide are suggestive, but not statistically evaluable since (a) equal numbers of cases in each category were not always available; (b) the number of cases in a category was not always large enough for statistical evaluation; e.g., in acute suppurative pulpitis, only eight cases were available.

†Only one negative culture required. In all other cases, two negative cultures were required.

tion. The bottle containing the sulfanilamide solution was labeled A, the ethylene glycol was labeled B and the sulfadiazine solution was labeled C.

The manner of using these solutions was similar to that already described for the microcrystalline suspension of the sulfonamides. The students, while they were told that they were using sulfonamide solutions, neither knew which sulfonamide nor did they know that one of the bottles contained a control solution (ethylene glycol).

In the series of cases to be reported here, only the data pertaining to the

Table 2.—Age and Sex Distribution

Age	Number of Cases
19 or under	56
20—29	47
30—39	20
40—49	13
50—59	8
60—69	3
Age not given	5
Sex	
Male	67
Female	85

15 per cent sulfanilamide and the 15 per cent sulfadiazine solution in ethylene glycol will be included. The control solution of ethylene glycol apparently exerted some slight antibacterial effect, but not nearly so great as that shown for the sulfonamide solutions. In about half of the control cases, a chemotherapeutic agent other than ethylene glycol had to be resorted to before negative cultures were obtained. The data for the ten controls are not included here.

Altogether, 152 teeth were treated with the concentrated sulfonamide solutions. Those treated with sulfanilamide and those treated with sulfadiazine, since there was no apparent difference in effectiveness between them, will be presented here as a single group (Table 1). Distribution of the cases with regard to age and sex of the patients and position of the teeth in the arch is given in Tables 2 and 3.

In order to determine the relative effectiveness of the sulfonamide treatments, the data were compared with a similar number in cases of the same diagnosis treated prior to the beginning of this study. Where the number of cases of the same diagnosis was smaller than the sulfonamide group, additional data were provided by cases treated immediately after this study was completed.

In the group used for comparison with the sulfonamide group, the medicaments employed were camphor-

Table 3.—Distribution of Teeth According to Position in Arch

	Maxillary	Mandibular
Incisors	64	6
Cuspids	17	8
Bicuspids	27	21
Molars	5	4
	113	39

ated monochlorphenol, azochloramid (chloroazodin U.S.P.), beechwood creosote or metacresol acetate. These drugs were used in rotation at each visit so as to preclude the possibility of acquired tolerance by the bacteria to continued use of the same drug. This principle, as applied in root canal therapy, has been presented elsewhere.[2]

With the exception of the chemotherapeutic agent, the preliminary method of treatment, i.e. mechanical or chemical preparation of the root canal, was identical in the two groups.

The criterion used for determining the effectiveness of the chemotherapeutic agent was the same in the two groups; i.e., the number of treatments required to yield two successive negative cultures.

2. Grossman, L. I.: Clinical Management of Pulpless Teeth. J. Ontario D. A., 17:2, July 1942.

The relative effectiveness in the sulfonamide group and the control group is presented in Table 4. It will be seen that, with only one exception, results in the sulfonamide group were inferior to those in the control group. Despite my enthusiastic hopes, a clinical impression was received, as the study progressed, that the sulfonamide-treated group did not require fewer treatments. This was later confirmed by an examination of the clinical records. The data presented in this paper were obtained from punched cards on which all clinical records of the oral medicine department of this school are kept. This method of keeping records and evaluating data has been described elsewhere.[3]

Table 4.—Number of Treatments Required to Yield Negative Cultures in Sulfonamide and in Control Group

Number of Cases Treated in Each Group	Diagnosis	Sulfonamide Group	Control Group*	Difference in Favor of Control Group
42	Acute serous pulpitis	4.9	3.4	1.5
8	Acute suppurative pulpitis	4.1	3.8	0.3
13	Chronic ulcerative pulpitis	5.0	3.4	1.6
1	Degeneration of pulp	3.0	4.0	.1.0
28	Necrosis or gangrene of pulp	6.8	4.5	2.3
7	Acute radicular abscess	7.0	5.4	1.6
11	Subacute radicular abscess	7.4	5.6	1.8
23	Chronic radicular abscess	6.2	5.4	0.8
4	Granuloma	6.9	5.3	1.6
16	Intentional extirpation*	2.0	1.4	0.6

*Only one negative culture required. In all other cases, two negative cultures were required.

In this group, used for comparison, the following medicaments were used in rotation: camphorated monochlorphenol, azochloramid (chloroazodin U.S.P.), beechwood creosote and metacresol acetate.

The concentrated sulfonamide solutions described here, while not found to be more effective than another means of sterilizing root canals, are only slightly inferior to that means and could be considered satisfactory for the treatment of pulpless teeth. They possess one outstanding virtue: they are not irritating. In only one case did periodontitis follow use of the sulfonamide solution.

3. Grossman, L. I.: Simple Method of Evaluating Clinical Data. J. D. Educ., 8:190, February 1944.

At least two reasons can be given for failure of the sulfonamide solutions to show greater antibacterial effectiveness: 1. The sulfonamides as a group are considered to be bacteriostatic rather than bactericidal. They prevent multiplication of micro-organisms, while actual destruction of the micro-organisms is effected by the leukocytes. These cells, although they may be present in the periapical tissue, are not present in the root canals of teeth to assist the action of the sulfonamide. It should be mentioned that, in the concentration used in this study, the sulfonamide solutions would be expected to exert a bactericidal rather than a bacteriostatic effect. 2. The sulfonamides are relatively ineffective in the presence of protein breakdown products, pus or bacterial products. Since, at least in the early stages of treatment, root canals may not be entirely free of masses of bacteria, tags of necrotic tissue or even pus, the sulfonamide solution would be less effective than a sterilizing agent the action of which is not markedly inhibited.

Summary

1. The root canals of 152 teeth were treated with a concentrated sulfonamide

solution after the canals had been mechanically prepared and had been irrigated.

2. The sulfonamide solutions used were *(a)* 15 per cent sulfanilamide in ethylene glycol and *(b)* 15 per cent sulfadiazine in ethylene glycol.

3. Ethylene glycol alone was used as a control solution.

4. The "blindfold" method of testing was employed; i.e., those using the sulfonamide solution or the control solution were not aware of its identity.

5. Diagnosis for diagnosis, the sulfonamide-treated group of 152 cases was compared with another group of 152 cases that had been treated by other medicaments.

6. The number of treatments required to yield two successive negative cultures was used as a measure of effectiveness of the root canal medicaments being studied.

7. The concentrated sulfonamide solutions were found to be almost as, but not quite so, effective as other root canal medicaments used for comparison in this study.

SUGGESTIONS FOR BETTER SILICATE FILLINGS

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As a matter of protection, it is important that the silicate cement used in dental practice be one that has been certified to comply with A.D.A. Specification No. 9. The directions supplied by the manufacturer should be studied and sufficient trial mixes made to assure familiarity with the recommended mixing technic and consistency. After the cavity has been prepared, the tooth to be restored and the approximal teeth should be given a prophylaxis.

It is necessary for the operator to have a knowledge of the modifying effects of one color on another. The lip should be raised only to the normal smiling position. The patient should face the light, with the operator standing directly in front of him. Normal lip shadows and oral shadows should be maintained.

Standing in front of the patient, the operator determines whether the tooth is predominantly yellow or gray or a blend. The color guide specimen which appears to match the portion of the tooth to be filled is carried to the mouth. A moist tooth must be matched with a wet color guide tab. When the proper shade is determined, the powder or powders indicated are used to obtain the selected color. If the color needs additional white, gray, yellow or brown, the modifying color is added in sufficient quantity to obtain the desired result. It is important to remember that silicates, when first mixed, are always light and that they do not take on their true color for about forty-eight hours.

The predominant colors in human teeth are orange-yellow and yellow-gray, or more briefly yellow and gray. The blue effect noted in some anterior teeth is due to the reflection of the dark oral shadows through the translucent incisal edges of very thin teeth. Where cases of this kind are examined closely, it will be noted that the incisal edges are thin and composed mostly of enamel without any dentin underlying at these edges. A cotton roll placed behind such teeth makes them appear lighter, but the extreme translucence of the incisal edges makes them appear darker in the mouth.

In mixing a silicate cement, only an agate, a stellite or a plastic spatula is used. Metallic spatulas, other than stellite, are not sufficiently hard to resist wear or scratches from spatulation. This lack of hardness is frequently the cause of grayish discoloration.

The ideal temperature for mixing silicate cements is between 65 and 75 F. The mixing tablet can best be chilled by being placed under cold running water. The evaporation of the water will chill the tablet. Adequate chilling of the mixing tablet minimizes the danger of setting of the silicate before it is placed in the cavity, thus permitting the operator more time for insertion. Mixing on a chilled mixing tablet also makes possible the incorporation of a slightly greater amount of powder, thus insuring a stronger, denser filling and greater permanence, with freedom from discoloration and granulation.

When the tablet is warm, there will not be time to incorporate enough powder in the liquid to make a proper mix. Consequently, when the mix contains insufficient powder, a filling weak in compressive strength and lacking in color value will result.

If the mixing tablet is chilled to below the dew point, there will be a condensation of moisture on it, which will ruin the mix through the addition of water. Care should, therefore, be taken to insure that the tablet is thoroughly dry. The cap must be returned to the powder bottle immediately after the powder has been dispensed.

Before the liquid is dispensed on the mixing tablet, the liquid bottle must be shaken and the liquid agitated by squeezing the pipet bulb several times. The correct amount of powder is placed on the mixing tablet and divided into half portions, which are divided into quarters, one of which is divided into eighths.

A minimum of 2 drops of liquid is placed on the mixing tablet and the half portion of powder is incorporated in it immediately. The rest of the powder should be introduced into the liquid as rapidly as the liquid can take it. The mix should be completed in one minute or less and the spatulation should be thorough and over a small area of the mixing tablet. Overspatulation of the material will break down the jell formation, making a weak, porous, brittle filling.

Cavity preparation for a silicate filling does not differ greatly from cavity preparation for other plastic filling materials. Sharp angles are not necessary since the silicate cement can be forced into rounded corners more easily than into sharp corners.

If a cement liner is necessary, a thin layer should be used so as to leave a bulk of silicate material. Within limits, the greater the bulk of silicate, the stronger the filling. A liner should provide protection to the pulp against acid penetration and against pressure and should prevent the penetration of heat or cold, thermal changes, in many cases, being the direct cause of devitalization of the pulp.

The margins of a cavity should not be beveled, as a beveled margin leaves a thin edge, which will break readily.

Zinc cement crystallizes owing to development of a fine crystalline structure. The crystals develop and mechanically interlock. Silicate cement hardens, the base being pulverized porcelain bound into a solid mass by a colloidal binder.

All cements should be kept in a special compartment of the dental cabinet away from the compartment in which medicaments are kept, as cements will absorb essential oils from the medicaments, with resultant discoloration and alteration in setting time.

The mixing tablet, spatula and noncorrosive instrument used with silicate cements should not be used with any other cement.

It is inadvisable to have more than one bottle of liquid at any one time as

liquid is very sensitive to air. Also, the liquid should not be uncapped for a longer period than necessary for dispensing purposes.

Liquid not properly stoppered will evaporate, a slow set resulting. All manufacturers who comply with A.D.A. Specifications No. 9 furnish 20 per cent more liquid in a bottle than is necessary to go with a bottle of powder. The use of a liquid frequently exposed to the air from an open bottle causes slow setting; therefore, such liquids should be discarded when four-fifths used.

The rubber dam should be used whenever possible as absolute dryness is essential for a successful restoration.

Assuming that the rubber dam has been placed and the cavity washed out and superficially dried with cotton, the operator proceeds with sterilization of the cavity, preferably with phenol. After sterilization, the cavity is swabbed out with a pledget of cotton slightly moistened with alcohol. The warm air syringe is then used until a surface dryness is obtained. If alcohol is used drastically, and followed with a hot air blast, too much of the normal moisture content of the tooth will be removed, overdehydration resulting. This is frequently the cause of pulp irritation and pulp death.

The matrix should always be adapted before mixing a silicate, to permit the operator to adapt the matrix for contour and contact. If the matrix is properly placed and contoured before mixing, the operator can concentrate on packing the filling for retention and form and be sure that no excess is squeezed up into the gingival or lingual margins, which are so difficult to reach and to finish properly. It will be found that every minute spent on fitting and placing the matrix before insertion will save many minutes in finishing the filling.

With the matrix in place and the silicate mixed and ready for insertion, the cement is placed in the cavity as quickly as possible with a slight excess, the insertion time being one minute or less. The matrix is placed over the filling and held for three minutes without disturbing. The filling should not adhere to the matrix after the three-minute period. If it does, the filling should be removed and another filling made.

After removal of the matrix, the filling should be covered with cocoa butter and left undisturbed for at least ten minutes, when the rough excess may be removed and the filling coated with a cavity lining. The final finishing is done at a subsequent visit.

Best results with regard to finishing can be obtained if the matrix is so accurately adapted that additional finishing becomes unnecessary. The finish obtained in this manner is smoother and more impervious to surface discoloration than when strips and disks are used.

The celluloid matrix should never be lifted to inspect the filling. The operator should not burnish over the filling or ask the patient or the nurse to hold the matrix, lest the "jell" be broken, reduction in compressive strength and absorption of discoloring matter resulting.

When necessary, finishing should be done with cuttlefish disks and strips on the labial and approximal surfaces. The disks and strips should be kept well lubricated with cocoa butter and run at low speed, with a light touch and lifting motion in order to reduce friction and the accompanying heat.

The lingual surface may be finished with small, preferably white, fine-grained mounted points lubricated with cocoa butter. If possible, the glazed surface at the contact point should not be disturbed. It is usually necessary to have previous separation in order to avoid disturbance.

In a dry area, all previously inserted fillings should be protected with a coating of cocoa butter. Silicate is an irreversible colloid inasmuch as, if it dries out, it loses moisture, which is never

entirely regained. Therefore, silicate is contraindicated for mouth breathers.

Surface disintegration may be caused by overmanipulation, mixing on a warm tablet or failure to insert the filling promptly, and very often by failure to hold the matrix immovable for three full minutes. Sometimes it may be caused by failing to protect the filling with cocoa butter or varnish after insertion or by too early or too careless finishing of the filling.

Faulty margins are caused by overmanipulation, failure to insert promptly, burnishing over the matrix strip, improper adaptation and placement of the matrix strip, and sometimes by improper cavity preparation such as beveling of margins or overhanging of margins.

Discoloration may indicate that the material is not so dense as it should normally be. If the stains go deeper than the surface, the material is granular, oral fluids and stains having penetrated owing to a broken jell.

Roughened surfaces permit adherence of mucous plaque and give rise to surface stains.

Pulp discomfort may be an indication of several things, but the following faulty points of operative technic are frequent causes: overdehydration, inadequate sterilization, failure to provide proper mechanical and thermal protection and pressure on thin dental walls or acid irritation, due to the use of faulty materials of too thin mixes.

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THE PULP TESTING PROBLEM: THE STIMULUS THRESHOLD OF THE DENTAL PULP AND THE PERIDENTAL MEMBRANE AS INDICATED BY ELECTRICAL MEANS*

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From the standpoint of the clinician, the various available criteria for determining pulp vitality have proved inadequate. The x-rays, which are the most widely employed means for determining the status of a pulp, present serious limitations because normal structures, or even pathologic areas involving vital teeth, cast shadows in the roentgenogram which are similar in appearance to shadows indicating pathologic conditions arising from pulpless teeth. Four common categories can be cited as illustrative.

1. Radiolucent shadows cast by normal structures in such relation to root apices as to be easily misinterpreted as evidence of disease. Examples: anterior palatine fossa; incisive and canine fossae; root apices denuded of bone; maxillary sinus; posterior palatine foramen and canal; nutrient canals; mental foramen; submaxillary fossa; inferior dental canal, large peridental space; dental papilla in incompletely formed roots.

2. Pathologic conditions adjacent to the roots of vital teeth appearing in the roentgenogram as similar to pathologic conditions adjacent to the roots of pulpless teeth. Examples: "cementomas" in the radiolucent stage; pericemental abscesses not involving tooth vitality; adamantoblastomas, including dentigerous

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and follicular cysts; osteoporosis circumscripta; Paget's disease; central bone cysts, and soft tissue tumors.

3. Pathologic conditions contiguous to the roots of pulpless teeth often mistaken for normal because, in some instances, they are radiolucent in the x-ray film. Examples: granuloma; radicular cyst.

4. Untreated pulpless teeth, roentgenographically negative. Examples: traumatized teeth, discolored teeth; teeth with gangrenous pulps; teeth containing large fillings.

Other Methods

Other means of determining loss of the pulp include thermal tests, excavation and exploration. While these too are valuable, they are limited in scope. The drawback in thermal testing is its inflexibility. Owing to the lack of temperature control, standardization is impossible in the face of the inherent variables. The problems here involve conductivity through enamel and dentin of varying thicknesses; the presence of metallic and nonmetallic fillings in the crown of a tooth; pulp calcifications, and subjective phenomena. Exploration and excavation are excellent measures where their use is feasible. Sound intact teeth do not easily lend themselves to this method of pulp testing, nor do teeth with partial restorations when it is desirable to preserve the restoration.

Most other methods advocated at one time or another are at best inferior to those already discussed.

The most accurate means of determining the irritability of living tissues and the one in most common use is an electrical stimulating current. The intensity may be accurately measured by meter registration and the current may be applied for a definite period. The stimulation may be increased slowly and withdrawn instantly, but, most important, actual thresholds can be determined.

The problem of pulp testing is complicated by factors not inherent in other tissues and therefore presents unusual obstacles. Numerous types of electrical pulp testers have been devised. The inadequacies of many of these instruments is discussed in another report.[1] The conditions creating difficulties in making reliable pulp tests by electrical means may be described as follows:

Resistance

The resistance of dry enamel is well over a million ohms. Enamel acts as a nonconductor of electricity and this fact constitutes a major problem to be overcome before the current can reach the pulp. This in itself accounts in large measure for the variety of commercial machines on the market today. Moistening the enamel reduces its resistance to approximately 50,000 ohms; but enamel resistance is variable, as is the resistance of the dentin. The thickness of the enamel, the amount of abrasion, the presence of secondary dentin, pulp recession and calcification are some of the variables encountered. These have been hindrances in the production of a satisfactory testing device. The efficiency of the contact developed between the electrode and the tooth surface is also important.

Interference of Peridental Membrane with Pulp Response

The pulp and the peridental membrane of a tooth, both irritable tissues, may be stimulated with the electrical current. Ordinarily, the pulp is the more irritable of the two, requiring less current for stimulation. In many instances, the zone separating the two responses is narrow. For this reason, in pulpless teeth, there is often a response to electric current from a painful peridental mem-

1. Ziskin, D. E., and Wald, A.: Observations on Electrical Pulp Testing. J. D. Res. 17:79, April 1938.

brane which may be erroneously interpreted as a sign of vitality. The experimental aspects of this phase of the pulp-testing problem have been discussed in other reports.[1, 2]

These experiments show that varying the stimulating current frequencies from 35 to 50,000 cycles caused variation in the threshold at which the pulp nerves responded. The higher the frequency, the higher the threshold. It was also observed that, at low frequencies, the margin between the pulp response and the peridental membrane response was slight, whereas higher frequencies served to separate the individual reactions. The optimum frequency for widest separation of the responses was found to be between 5,000 and 10,000 cycles. The most significant finding in these studies was the fact that the pulp and peridental membrane tissues have different thresholds of irritability.

In preparing for the present study great difficulty was involved in constructing a practical apparatus for delivering optimum frequency. Therefore, the usual line current was employed, and the problem of a clear distinction between the pulp and peridental membrane response at this low frequency was met by certain refinements in method. These are discussed under "Technic."

Testing at Threshold of Stimulation.—In nerve testing, it is essential that responses be elicited at the threshold; i.e., the least amount of current to which there will be a reaction. This is important since, in most electrical technics, a sound tooth of unquestionable vitality is used as a control. If the currents are not measured at the threshold, the comparisons are invalid. On the whole, the commercial equipment available today does not provide a satisfactory means of determining the threshold.

Current Leakage.—Not all current applied reaches the pulp, but only a portion is necessary for pulp stimulation. The remainder, although measured, is nonstimulative and constitutes one form of current leakage. The loss is small and of little practical significance. When a single electrode is applied to the tooth and another, larger electrode is held in the hand, the path of the current is likely to involve the pulp. If any moisture is present on the surface of the tooth in proximity to both the electrode and the gingivae, most of the current is diverted to the soft tissues via the surface, and little is available for pulp stimulation. This is another form of current leakage. Some current leakage is unavoidable even under exacting conditions, but, under careless conditions, current leakage becomes comparably much greater. Since all current is measured, such leakage leads to gross errors in interpretation of tests.

Subjective Responses.—Owing to the fact that determination of the threshold is dependent on the patient's indication of sensory response, the best tests are no more reliable than the individual patient's ability to signify that the threshold has been reached.

The method of overcoming this objection is discussed under "Technic."

Current Versus Voltage Measurements.—In the solution of these problems, we considered the relative merits of current over voltage measurement. Mackta[2] reported that, in pulp testing, the stimulating current traverses a circuit composed of the enamel, the dentin, the membrane about the nerve and the skin. He stated that the resistance of these are all effectively connected in series. It has been found that the resistance of enamel and dentin varies greatly from person to person and from tooth to tooth as a result of wear, degree of calcification and secondary changes. The resistance of the membranes, such as those surrounding a

2. Mackta, L.: Electrical Nerve Stimulation as Applied to Dental Nerves. Columbia D. Rev. 9:6, May 1938.

nerve, does not change except in cases of gross pathologic changes. In the case of a threshold current passing through all the above-mentioned resistance areas in series, the potential drop across each area is equal to the current through it times the value of its resistance or I×R.[3] The potential drop across the enamel and dentin will be variable, depending on its thickness, calcification and other conditions, while the drop across the membrane surrounding the nerve will depend on its constant resistance. If we assume that the potential difference between the nerve and its environment is what stimulates it, by measuring the current through the entire system we have an idea of the potential or voltage stimulating the nerve. Actually, the principles involved are much more complicated than the simple description given here, but the generalities are applicable.[4-7] Were the entire voltage across the system to be measured instead of the current through it, the sum of the potential drops across each resistance area would be obtained. Since the drop across the enamel and dentin is so variable, there would be no way of determining what part of the total voltage to apportion to them and what part to attribute to the internal membranes. Therefore, it will be seen that there is a theoretical justification for measurement of threshold current rather than threshold voltage.[8]

3. Schaefer, H.: Elektrophysiologie 1:9, 1940.

4. Lullies, H.: Methoden der elektrische Reizung von Muskeln und Nerven, Handb. der Biol. Arbeitsmeth. Pt. 5A. 2:937, 1937.

5. Katz, B.: Electrical Excitation of Nerve. London: Oxford University Press, 1939.

6. Lapecque, L.: La Chronaxie sa Significance et sa Mesure. Paris: Universal Press of France, 1926.

7. Terman, F. E.: Radio Engineers Handbook. New York: McGraw-Hill Book Co., 1943.

8. Curtis, H. J., and Cole, K. S.: Nerve Excitation and Propagation; in Medical Physics (O. Glasser, editor). Chicago: Year Book Publishers, 1944, p. 798.

As far as we have been able to ascertain, all vitality pulp testers on the commercial market are calibrated in volts, either by direct meter readings or by divisions on a sliding scale. The purpose of this report is to describe the equipment and the method of electrical pulp testing commonly employed by us, and to list the findings from actual tests of 1,605 teeth.

Methods

The Apparatus.—In order to make tests at the threshold, the apparatus was constructed so that a current of constant wave shape could be increased slowly at a uniform speed until stimulation resulted. The shock thus activated is slight, yet definite enough to be reproducible at the same meter reading. Our machine, employing a current meter accurately calibrated to read microamperes, measures stimulating current and is provided with a dial that can be turned slowly and at a fairly constant rate to avoid sudden surges beyond the threshold point. The meter constitutes a visual aid in controlling the current and observing fluctuation.

A frequency of 60 cycles on an AC house line is employed. It is equipped with a 600 rectifier Weston type meter having a range of 0-100 microamperes. Shunts have been provided to multiply the range of the meter five times. This range has proved adequate in every case thus far encountered. For research purposes, in gathering data concerning voltage readings at the threshold, a wire-wound General Radio potentiometer with a resistance of 2500 ohms, calibrated in volts, was incorporated. The transformer is of the midget radio power type using half of the high voltage winding as the primary and the usual primary winding for the output so that it delivers about 100 volts from the 110 volt line. Six hundred volt insulation adequately isolates the patient from the power lines. To avoid registering stray currents, a

ground wire is attached to the tester at the hand electrode. Voltage and microampere calibrations were tested with control instruments for accuracy.

There are two types of electrodes in common use with pulp-testing apparatus: the two-prong single electrode and the two separate contact types. In the latter, the hand electrode is an "indifferent" one covering a large area so that it produces a current of little density and therefore does not stimulate. The other electrode is small, producing a current of great density at the point to be stimulated. In the two-prong type, a current of great density is produced at both prongs, but both are at the point to be stimulated. In a consideration of both types, we chose the separate electrode system, for the following reasons:

1. In the event that there are large metallic fillings in a tooth, the single point electrode is more apt to avoid contact with the metal. Such contact will short circuit a current to the gums, and no current will flow through the pulp.

2. The pathway of the current is more likely to involve the pulp when one electrode is placed on the tooth, the other at a distant point. This is especially true when the electrode is placed on the incisal or occlusal surfaces. With the bipolar electrode, most of the current leaks across the surface of the tooth, since each contact must be wet and contacts are spaced about 2 mm. apart. Since application of metal electrodes to the hard and unyielding tooth substance causes extreme fluctuation in the meter reading, we devised an electrode depending for its contact with the tooth surface on a wooden plug about 2 mm. in diameter incased in a hollow metal tube covering all surfaces of the plug closely and leaving only the contact end free. Bakelite covers the electrode so that it can easily be held in the hand. The wooden plug, which protrudes about 1 mm. beyond the metal tube, is soaked in a saline solution; which enhances its conductivity and softens it so that it conforms to the contour of the tooth. Thus, the electrode does not slip readily and undesirable current-meter fluttering is eliminated.

The hand electrode is of metal, being similar to the commercial device. A moistened gauze square is wrapped about the handpiece to insure conductivity.

The Technic.—The tooth to be tested is isolated with cotton rolls and its crown surfaces are dried with compressed air. The cotton rolls do not contact the tooth. The tooth electrode is dipped in a concentrated saline solution and the excess moisture is shaken off to prevent fluid contact with the gingiva or the adjacent tooth. The patient is asked to hold the hand electrode firmly in the right hand.

The electrode is then placed on the incisal surface of anterior teeth and the occlusal grooves of posterior teeth. These are the primary surfaces of choice. The second choice is the labial surface of the anterior and the buccal surface of the posterior teeth. While the electrode is held in contact with the tooth with a steady even pressure, the voltage is slowly increased until the patient responds by raising his free hand. He usually describes the sensation as "heat" or "mild drilling." At this moment, the current reading recorded on the meter in microamperes is observed and the electrode removed from contact with the tooth. The microampere indicator should move only on increasing the voltage. If the indicator continues to move after the voltage increase stops, or if it shows a rapid rise in current with the slightest increase in voltage, current leakage is responsible and the reading must be considered erroneous. Should stimulation occur, the patient will describe it as "gripping the tooth" and different from pulp stimulation.

Faulty details such as the presence of a film of moisture or contact of moist cotton rolls with the tooth and gingiva or poor electrode contact are quickly de-

Table 1.—Pertinent Data

1-5	Name			Record No.		Case No.	
6-7	Tooth		Tooth Findings		Pulp Test		Vitality Response
8	Age		Sound tooth	1	Microamperes	13	Vital
6	6-15	8	No cavity or filling	1	1— 10	1	Response
7	16-25	9	History of injury	2	11— 20	2	No response
8	26-50	10		3	21— 30		Nonvital
9	Over 50		Abrasion	4	31— 50	3	Peridental membrane response
	Sex and Race	Y	1st degree	5	51— 70		
		X	2nd degree	6	71—100	4	No response
		0	3rd degree	7	101—200		
			Pulp recession	8	201 or over	5	Other
0	White—male	1	1st degree	12	Volts		
1	Female	2	2nd degree	1	1— 10		
2	Negro—male	3	3rd degree	2	11— 20		
3	Female			3	21— 30		
			Caries	4	31— 50		
9	X-ray examination	4	1st degree	5	51— 70		
		5	2nd degree	6	71—100		
Y	Not made	6	3rd degree				
X	Positive		Fillings				
0	Negative	7	Metallic				
		8	Nonmetallic				
		9	Other				

tected by erratic current readings, as described above. These fluctuations are caused by resistance changes due to surface leakage of current. While similar care must be exercised with the testers on the market, the difference lies in the fact that these mechanisms are calibrated in volts and are not equipped to indicate errors in technic caused by careless execution of procedures. As a result, their tests are unreliable. Moreover, with our equipment, mechanical defects such as broken connections and improper wiring are quickly perceived because, under such conditions, the current fails to flow through the meter.

Before making a test, an unquestionably vital tooth, comparable as to location or type, is tested in order to give the patient the experience of the sensation to be expected and also to establish a control reading. Repeat tests are made, as the second or third trial usually results in a lower current meter reading. This is so because, with repetition, the patient becomes discriminating and is able to recognize the threshold more precisely. The lowest meter indication constitutes the threshold. One or more repeat tests at the established threshold are then made, virtually eliminating the weakness of the subjective criteria. Compound metal fillings in close proximity to the gingivae are to be avoided as contacts in electrical vitality tests since they readily conduct the current to the gingiva, and thus a gingival or peridental membrane response is elicited instead of the desired pulp reaction. The only metallic fillings that may be used as contact points are simple occlusal or small buccal fillings which are not in contact with the

surrounding soft tissues and which are surrounded by sound enamel on all sides. For the same reason, crowned teeth cannot be tested unless the crown is removed.

Caution in interpretation of tests is exercised in the following instances:

Multirooted teeth may give vital responses when one root is vital and the others are pulpless. Other means of diagnosis, such as excavation, are resorted to in such cases.

Wherever periodontitis is present, special care is taken in applying the tooth electrode as excess contact pressure may elicit a pain reaction in the periodontium and confuse the issue.

When the tooth electrode is held too close to the soft tissue, the current flow may be diverted to the gingivae.

Since resistance varies directly with the thickness of the enamel, in rare instances it was found that the normal voltage of the tester was insufficient to overcome the tooth resistance. In these cases, a careful search was made for possible areas of lower resistance in the tooth crown. If this failed, a hole was drilled through the enamel for the placement of the tooth electrode. This procedure was usually effective.

Patients under the influence of drugs, narcotics or alcohol appear to be less susceptible to electrical stimulation than others. Lesions of the central nervous system (such as those caused by syphilis and endocrine imbalance) also seemed to render the patient less fit for electrical pulp tests.

Statistical Analyses

Tests were made on 1,605 teeth by the methods and with the apparatus described. Of these, 1,289 were vital and 316 were pulpless. Of these teeth, 1,047 were incisors and cuspids; of these, 235 were pulpless. Bicuspids and molars numbered 558, of which eighty-one were pulpless.

A record card (shown in Table 1)providing all pertinent data was completely filled in for every tooth tested. Incomplete charts were discarded.

The patients were divided into four age groups: 6 to 15, 16 to 25, 26 to 50 and over 50. The sex and color (white or colored) were noted. Roentgenographic findings were recorded. The condition of the tooth was described; e.g., sound tooth with or without a history of injury, abrasion, pulp recession, caries and fillings.

The results of the pulp tests were tabulated in one of eight categories in microamperes, and in one of six categories in volts. The responses were classified as "vital" or "nonvital." The nonvital readings were interpreted as either "no response" or "peridental membrane response."

A preliminary survey utilizing statistical methods showed that most of the factors recorded had no significant bearing individually and could therefore be combined into groups of sufficient size to render the analyses valid. For example, differences were found in the responses at the age levels below 25 years as compared with those over 25 years; but the variations were so small as to be negligible from a practical standpoint. Therefore, in the final evaluation, no breakdown in age was made. With the same method of regrouping, the incisors and cuspids were placed in one category (the anterior teeth) and the bicuspids and molars in a second category (the posterior) after a separate analysis of each of the four groups disclosed a sharp difference in the responses of the anterior teeth when compared with the posterior teeth.

There was no significant difference in threshold response according to sex and race.

The analyses for tooth findings as seen in Table 1 also yielded no significant differences; i.e., sound teeth responded at

Table 2.—Vital Teeth

Meter Readings	Anterior*				Posterior†			
	Microamperes		Volts		Microamperes		Volts	
	Teeth	Per Cent	Teeth	Per Cent	Teeth	Per Cent	Teeth	Per Cent
1— 20	782	96.1	690	85.6				
21— 30	23	3.1	51	6.4	459‡	96.2	409	85.7
31— 50	6	0.7	41	5.5	17	3.6	45	9.4
51— 70	1	0.1	14	1.8	1	0.2	14	3.0
71—100	0	0.0	6	0.7	0	0.0	9	1.9
101—200	0	0.0			0	0.0		
201 and over	0	0.0			0	0.0		

*812 vital incisors and cuspids.
†477 vital bicuspids and molars.
‡1—30.

thresholds that were comparable with those for filled teeth, carious teeth, etc. Consequently, no group separations were made.

The preliminary survey of pulp testing results showed that the microampere readings were definitely and consistently grouped, whereas the volt readings were scattered haphazardly.

Results

Table 2 includes the group of teeth that were considered vital on the basis of the electrical pulp tests. Confirmation was provided by tests on control teeth, x-ray films, history and, in some cases, excavation and observation over a long period of time, and thermal tests.

Of the anterior teeth, 96.1 per cent responded under 20 microamperes; 85.6 per cent under 20 volts. Of the anterior teeth, 99.2 per cent responded under 30 microamperes; 92 per cent under 30 volts.

Of the posterior teeth, 96.2 per cent responded under 30 microamperes; 85.7 per cent under 30 volts. In the small group of anterior teeth (3.9 per cent) requiring more than 20 microamperes for a response, the designation "vital" was applied only when all supplementary criteria gave positive indications and when the control teeth showed a correspondingly high threshold.

For the group which were "nonvital," according to test, confirming procedures included tests on control teeth, x-ray examination, excavation, drilling into the pulp chamber and insertion of a broach into the root canal. Finally, either root-canal therapy or extraction was resorted to. The pulpless teeth were divided into two series: those giving responses often misinterpreted as arising from the pulp, but which are actually peridental membrane responses (Table 3), and those which did not react to electrical stimulation (Table 4).

From Table 3, it will be seen that no pulpless anterior teeth responded in the 1 to 20 microampere range, whereas 41.3 per cent of these registered responses in the 1 to 20 volt range. Only one tooth, or 1.3 per cent of the pulpless anterior teeth, responded to less than 30 microamperes of current, 61.3 per cent responding to less than 30 volts. Of the pulpless posterior teeth, 75 per cent responded to less than 30 volts, none responding to less than 30 microamperes. It is of further significance that these 103 pulpless teeth giving peridental mem-

brane responses constituted 32.6 per cent of the pulpless group.

The teeth listed in Table 4 did not react to stimuli. In most cases, the complete output of the machine was employed; i.e., 100 volts. In view of the fact that this series were likewise shown to be pulpless by the various additional means heretofore described, it is possible that, for a peridental membrane response, these cases required a higher voltage than was delivered or that the peridental membrane was in a state of degeneration.

The accompanying tabulations were based on individual readings and on separate analyses of microamperes on the one hand and volts on the other. A comparative group study of these data reveals the following: forty-two of 316 pulpless teeth (13.3 per cent) responded at high microampere readings (51 to 201 or over) and low voltage (1 to 20). It has been frequently reported in the literature that these low voltage readings are well within the limits for normal vital pulp responses. Of 1,289 vital teeth, 122 (9.5 per cent) gave low microampere readings (1 to 30), but high voltage. Conversely, some investigators have stated that teeth responding at high voltages fall into the pulpless category.

Comment

A review of the statistical data shows current meter readings of less than 20 microamperes for 96.1 per cent of the vital anterior teeth, and a recorded voltage of less than 20 for 85.6 per cent of this group. Since the difference here between the microampere and voltage method of measurement is only about 11 per cent, there would seem to be little justification for abandoning prevailing procedures in favor of the one described herein. Experience has indicated that the majority of teeth tested are vital. Consequently, while an error of 11 per cent does not appear inordinate in itself, the cumulative results may involve a large number of teeth. Furthermore, the findings on pulpless teeth intensify the advantages of accuracy in the microampere system.

Of those pulpless teeth in which there was response in the peridental membrane, none of the anterior teeth responded to less than 20 microamperes, while 41.3 per cent responded to less than 20 volts. By drawing an arbitrary

Table 3.—Pulpless Teeth

Meter Readings	Anterior*				Posterior†			
	Microamperes		Volts		Microamperes		Volts	
	Teeth	Per Cent	Teeth	Per Cent	Teeth	Per Cent	Teeth	Per Cent
1— 20	0	0.0	31	41.3				
21— 30	1	1.3	15	20.0	0‡	0.0	21	75.0
31— 50	16	21.3	9	12.0	3	10.7	2	7.1
51— 70	5	6.7	7	9.3	6	21.4	2	7.1
71—100	24	32.0	13	17.4	12	43.0	3	10.8
101—200	15	20.0			3	10.7		
201 and over	14	8.7			4	14.2		

*Seventy-five pulpless incisors and cuspids.

†Twenty-eight pulpless bicuspids and molars.

‡All teeth in this category gave responses which are often misinterpreted as vital responses, but actually are peridental membrane responses. These 103 teeth constituted 32.6 per cent of the pulpless group.

line at 30 microamperes, it was found that only 1.3 per cent of the pulpless anterior teeth and none of the posterior gave a response, while at 30 volts 61.3 per cent of the anterior and 75 per cent of the posterior pulpless teeth responded. It is further significant that of all the pulpless teeth tested, about one-third fell into the category of those reacting through the peridental membrane rather than the pulp.

An additional advantage to testing by means of microamperes instead of volts is emphasized in Table 3, wherein a group of teeth show the highest microampere readings (350) at less than full voltage, owing to contact with isolated metal fillings. The presence of the metal diminishes tooth resistance. This supports the premise stated earlier that voltage is commensurate with tooth resistance rather than pulp threshold irritability.

Summary and Conclusions

The disadvantages of determining pulp vitality by means of volt-recording devices are:

1. Voltage measurement is a better indicator of tooth resistance than of pulp threshold irritability as the voltage necessary to overcome tooth resistance is proportional to it.

2. The peridental membrane is an irritable tissue capable of stimulation by electricity. There is no provision in volt-recording instruments for detecting such responses. Consequently, they are often misinterpreted as vital pulp reactions.

3. In order to obtain quantitative measurements of pulp irritability, it is necessary to test at the threshold. Most commercial apparatus available are of the volt-recording type and, to the best of our knowledge, are not equipped to test in this manner.

4. Errors in technic such as current leakage, breaking of wires or other mechanical defects are not discernible in volt-recording machines because there is no provision made for determining whether a current is actually passing through the pulp. The clinician is unable to determine whether an absence of response on high voltage is due to lack of vitality or to faulty technic.

The advantages of the current-measuring devices are:

1. The problem of tooth resistance becomes insignificant.

2. The ability to test at the threshold makes possible quantitative evaluations of pulp responses. Threshold readings can be duplicated and, within limits, are constant, in most instances.

3. Errors in technic and mechanical defects are readily perceptible.

4. Peridental membrane responses are categorically established and are readily differentiated from pulp response.

On the basis of 1,605 teeth tested with an apparatus calibrated in both microamperes and volts and constructed to test at the threshold, it was found that:

1. The normal threshold of stimulation for anterior vital teeth was between

*Table 4.—Pulpless Teeth**

Meter Readings	Anterior		Posterior	
	Microamperes		Microamperes	
	Teeth	Per Cent	Teeth	Per Cent
1— 20	2	1.2	1†	1.9
21— 30	1	0.6		
31— 50	19	11.9	4	7.5
51— 70	14	8.7	3	5.6
71—100	47	24.4	18	34.0
100—200	30	18.8	11	20.8
201 and over	47	29.4	16	30.2

*All teeth in this category (160 anterior; 53 posterior) were pulpless and did not respond to electrical stimulation. This group differed from those in Table 3 in that the peridental membrane response was not elicited. All but seven anterior and eight posterior teeth registered the maximum voltage (100 volts). The fifteen exceptions gave highest microampere registrations accompanied by less than full scale voltage readings (probably because of contact with metal fillings).

†1—30.

1 and 20 microamperes and for posterior vital teeth between 1 and 30 microamperes.

2. In most pulpless teeth in which there was a peridental membrane response, this occurred at readings of between 51 and 100 microamperes, whereas most of the remainder of the pulpless series took between 70 and 350 microamperes of current under the full voltage (100).

3. The current measuring equipment is superior to apparatus employing volt measurements in determining pulp vitality.

630 West 168 Street.

FURTHER TESTIMONY FROM HEARINGS ON DENTAL RESEARCH AND GRANTS-IN-AID-BILLS. III (IV)

DR. CAMALIER, *continuing:* All of these subjects, if properly approached, will demand research as a basis for advanced technics and treatment in the interest of the health of the people. Some progressive features of this training might be referred, with profit, to this proposed National Institute of Health, where those classified as experts would be in a position to respond to inquiries and secure concrete results to the great advantage of the health of the people. In other words, this coordinating agency—this centralized institution—where specific methods would be employed to achieve the maximum results would, in my opinion, meet a vital need. More teachers would naturally be required and the positions created by the passage of this legislation would be available to our returning veteran officers, giving those so inclined an opportunity to pursue their inventive tendencies unburdened with the necessity of caring for a busy practice in order to maintain a livelihood.

I urge the passage of this legislation because it is constructive and gives first consideration to the dental health of the people of the United States, with special reference to the children of the nation. The establishment of this great National Institute of Health will mean much to the parents and children of this country, and it is my firm conviction that those who are responsible for the enactment of this legislation will receive the everlasting gratitude of the people of the United States. The official slogan of the American Dental Association is "Dental Health for American Youth," and this legislation seems to be the first step to achieve maximum and worth while results within a reasonable period of time.

SENATOR TUNNELL: Do you mean that they would deserve the gratitude, or would receive the gratitude?

DR. CAMALIER: Well, they will receive the gratitude, I should think, because, after all, this strikes home to the families in America, and we feel that the first approach to this is research, and on the basis of that we hope to obtain very great results in the future.

I would say that, in ten years, we should see very great results from these studies and research, but of course no one can say definitely about that, but it seems, Mr. Chairman, that would be the first step we should pursue.

SENATOR SMITH: Doctor, are there any important centers where dental research is being carried out throughout the country?

DR. CAMALIER: The National Institute of Health is the principal one; the University of Michigan is one, Minnesota, and most of the accredited dental schools. Dr. Jay can check me on that.

SENATOR SMITH: The PHS has a branch, hasn't it?

DR. CAMALIER: Yes.

SENATOR SMITH: I am trying to think through whether we are setting up something new which will be federal in its whole structure, or whether we will be moving in to bolster up and expand the work that may be going on now in these private institutions; or do you think the private institute route is inadequate?

DR. CAMALIER: Oh, yes, I think so at the present time. I don't think we have scratched the surface of it at all, and it would seem to me we would have to expand it throughout the regions of the United States in order to get the best results.

SENATOR TUNNELL: What is your thought, that the research will result in the improvement of the dentists themselves, or will it result in the people appreciating the problems to a greater extent and having their teeth treated?

DR. CAMALIER: I should think, Senator, if we look at it from the standpoint of the dentists, we might be losing on this.

SENATOR TUNNELL: They have all they can do anyway, haven't they?

DR. CAMALIER: Yes; at the present time we do, especially with the men in the service.

SENATOR TUNNELL: I wasn't thinking of it from a selfish standpoint. I am thinking of it from the standpoint of the effect.

DR. CAMALIER: I think the effect would be very greatly to the benefit of the parents in the country, and their children.

SENATOR TUNNELL: That is, they would have a greater appreciation of the necessity for treatment?

DR. CAMALIER: Yes; a very much greater appreciation.

SENATOR AIKEN: Any further questions? Thank you.

DR. MEAD: In regard to the places where research is being done, I might add dental research is being conducted in all of the accredited dental schools in the United States as that is one of the provisions for their accreditation. The United States Public Health Service, the Army and Navy, the American Dental Association and a few private institutions are also conducting dental research studies. Many dentists in private practice, at their own expense have done and are doing much in this field. However, because of limited funds, facilities, and personnel, the combined research activities of these institutions and individuals are inadequate.

Our last witness is Dr. Lon W. Morrey, of Chicago, the director of the Bureau of Public Relations of the American Dental Association, who will give a general summary of our discussion.

TESTIMONY OF DR. LON W. MORREY, DIRECTOR OF BUREAU OF PUBLIC RELATIONS OF THE AMERICAN DENTAL ASSOCIATION, CHICAGO, ILL.

DR. MORREY: Mr. Chairman, members of the subcommittee: My name is Lon W. Morrey. I reside in Chicago, and I am director of the Bureau of Public Relations of the American Dental Association. I believe that the research bill, S. 190, and the other measure, S. 1099, that will be considered by this committee, are of tremendous importance because they lay the groundwork for a logical, practical, scientific and long-range approach to the great problems of dental disease.

If facilities for dental research are expanded, there cannot help but be an increased knowledge of the causes of dental diseases, which now attack almost the entire population. Out of this knowledge will come better methods of preventing and controlling dental diseases. This means that within the space of some years the size of the dental problem, and its cost will be cut down materially. Unless, therefore, this most important initial step of intensified dental research is taken now, the country can look forward to a steady toll of dental disease and repeated expenditures for their correction, with little or no hope of ever reducing them.

The amount of money which this bill appropriates is almost insignificant in terms of the improved dental health which it will eventually produce. Very little money is now being spent by the Federal Government on the dental problem. In fact, only very limited resources have been available for dental research from any source. The appropriation of $1,000,000 will build and equip a national institute of dental research as an integral part of the great National Institute of Health at Bethesda. The additional appropriation of three-quarters of a million dollars annually will enable many other public and private agencies throughout the country to develop and expand constructive programs of dental research. There are many reasons why dental research should receive the support of the Federal Government. In the past, very little money has been spent on this problem, which is certainly worthy of national attention.

The United States Public Health Service has available tremendous resources in the fields of science associated with dental problems and the dental department of the service, even under a limited program, has made many significant contributions to dental knowledge. The passage of this bill will enable the Public Health Service to expand its dental facilities and to utilize an increased personnel which will devote itself primarily to dental problems.

Through grants-in-aid for dental research, this bill will provide long-needed support for public and private agencies by the allocation of funds specifically for dental purposes. This will aid in correcting the long-standing practice under which restricted research funds were applied, perhaps understandably, to the more dramatic diseases. Dental diseases do not have these dramatic and immediate implications, but they do take an indefensible toll in human well-being.

The dental research bill represents a productive, long-range investment in the health of the American people. Its passage will pay dividends in health and in ultimate reduction of the cost of rendering dental service to the people of this country. Its passage will mark the beginning, which has already been too long delayed, of a real dental health program in this country.

SENATOR SMITH: By whom was this bill prepared, the Dental Association? Was it prepared by the doctors themselves?

DR. MORREY: Our committee assisted in its preparation.

SENATOR SMITH: This is 190 you are talking about now?

DR. MORREY: S. 190, yes.

SENATOR SMITH: I assume that we will take up 190 again tomorrow, the research bill. I was wondering what its origin was and whether it came from your dental group.

MR. MALMBERG: Dr. Morrey, do you have any idea of the amount of money now spent

for dental research? I don't think anybody has touched on that subject.

DR. MORREY: No. I think Dr. Jay could probably answer that question better than anyone else in the room.

DR. JAY: I think at the present time most of it is being spent by Dr. Parran, because there is not much available in the universities.

SENATOR AIKEN: I wonder if Dr. Parran would like to answer the question asked a short time ago by Senator Smith as to the relationship between the federal and institutional research work in the event the bill is enacted into law—whether there is likely to be much duplication of conflict between the two methods or research or not.

TESTIMONY OF SURGEON GENERAL THOMAS PARRAN—Resumed

DR. PARRAN: I should be very glad, Mr. Chairman, if I may, to answer Senator Smith's question. Those of you familiar with the provisions of Public Law 410 will find that the National Cancer Institute Act is carried forward in Public Law 410 as title IV of that act. The bill before you, S. 190, uses almost exactly the same terms as were used in the National Cancer Institute Act, except that the words "dental health" or "dental disease" are substitutes for the word "cancer."

Our experience in operating the National Cancer Institute, following the best advice that we could get in that great field in which research had been so badly neglected, also indicated that we needed two approaches: One, a federal center for collecting information from institutions in this country and abroad, for sponsoring round-table discussions and analyses of the different aspects of the problem and for making recommendations as to the most effective ways of dealing with one or another of the questions which arise in connection with, in this case, cancer.

In some instances, the research project is being carried out in the National Cancer Institute itself.

In other instances, a research fellow, a brilliant young research mind, is brought into the institute to work on an idea of his own; and in still other instances, and this is the second approach, a research fellow is appointed for work in his own university or some other university offering him facilities. Along the same lines, grants-in-aid are made for projects submitted by an individual university or by a group within the university.

The National Cancer Institute has gone further in that it has deliberately stimulated interest in other research centers and has encouraged them to add to their already good staff in order to undertake research in cancer in addition to the types of research which had previously been carried on.

Sometimes the several parts of a particular problem are parceled out among three or more universities so that the findings in each could be added together, making a greater result than the sum of the individual parts.

I have taken this time to explain how the National Cancer Institute operates because I visualize the National Institute for Dental Research functioning in exactly the same way.

There is one important provision which has not been emphasized, Mr. Chairman. The concept behind S. 190, as behind the National Cancer Control Act, is that the administration is shared between the Surgeon General and the National Advisory Dental Research Council. I would refer you to the language of section 2:

> The Surgeon General of the Public Health Service is authorized and directed for the purposes of this Act and subject to its provisions, through the Institute and in cooperation with the National Advisory Dental Research Council hereinafter established, to conduct researches, to promote the coordination of researches, to provide fellowships, to secure expert consultation here and abroad, and to cooperate with state health agencies. . . .

Then under section 4, that general mandate, in cooperation with the Council, is specified in further detail. The Council is given certain very specific functions, the most important of which appears under section 4 (a). It is authorized

> to review research projects or programs submitted to it or initiated by it—that is the Council—relating to the study of the cause, prevention or methods of diagnosis and treatment of dental diseases and conditions, and certify approval to the Surgeon General of such projects which it believes show promise.

In other words, no grant-in-aid would be authorized under S. 190, and no grant-in-aid is authorized under the National Cancer Act, unless that grant is recommended by a council composed of research experts. I think that is an important provision. It has worked extremely well in connection with the cancer problem. It ensures continued participation and cooperation of the dental profession and the research group in carrying out the program.

DR. MEAD: May I make one statement, answering one question. The bill on dental research was prepared by the legislative committee of the American Dental Association, by request of the House of Delegates, and this bill was finally put into its present shape after consultation with all of the different groups and agencies involved and has undergone study by your committee, with certain amendments.

SENATOR SMITH: Might I ask, is that true of 1099 also?

DR. MEAD: Yes, sir; that is true. We prepared both bills and introduced them. Certain amendments have been introduced, but the stimulus for the bills came from our organization.

SENATOR TUNNELL: You didn't think it was wise to put them into one?

DR. MEAD: I would like to answer that tomorrow. We haven't considered that and we would like to bring it up tomorrow after we have had an opportunity to consider that.

SENATOR TUNNELL: It seems that I came the wrong day or asked the wrong person.

CHAIRMAN AIKEN: The next witness is Dr. Russell Dixon, Washington, D. C. Will you identify yourself for the record?

TESTIMONY OF DR. RUSSELL A. DIXON, DEAN, COLLEGE OF DENTISTRY, HOWARD UNIVERSITY, WASHINGTON, D. C.

DR. DIXON: I am Russell A. Dixon. I received my undergraduate training for the degree of doctor of dental surgery at Northwestern University. My graduate education was received in the same institution, where I was given the degree of master of dental science in 1933. For sixteen years, I have been engaged in dental education, the last fourteen of which I have served as dean of the College of Dentistry of Howard University, Washington, D. C. I have been a member of the National Dental Association since it emerged into a national organization in 1932. I served five years on its executive board and am now chairman of the committee on educational extension.

I have a statement that I would like to read, particularly since I find that my concepts probably differ in some particulars from most of those expressed so far today. . . .

Because of limitations of space, Dr. Dixon's testimony is not printed in full. The complete statement will be found in the published record of the hearings which is available from the U. S. Government Printing Office, Washington, D. C.

To this end, I should like to ask that S. 190 be amended as follows:

(1) On page 3, line 13, after the word "dentists" add a comma and the following:

one of whom shall be a member of any population group or groups separate by law from the rest of the population of any State.

(2) On page 8, line 16, after the word "Act," delete the period, add a comma and the following:

including the fact that there shall be an equitable distribution of funds, services, and participation in the program by all groups in the population. . . .

Because of the discrimination against Negroes in organized dentistry and because of the need for protective legislation for all minorities in the expenditure of public funds, it is necessary in connection with S. 1099 to request the following amendments:

(1) On page 3, line 19, after the comma following the word "States," add the following:

Provided, That in those States where segregation exists by law, the allotment will be specifically divided on the basis of the white population and the Negro population and used respectively for the white population and Negro population.

(2) On page 6, after line 9, add the following subsections:

(h) There shall be an equitable distribution of funds, services and participation in the program by all groups in the population.

(i) The Surgeon General shall cause an audit to be made of the expenditures of funds under the Act by each State health director. Such audits shall at all times be available for public inspection. If either before or after an audit has been made any person shall complain to the Surgeon General that he has reasons to believe that any portion of the funds appropriated under this Act have been expended by any State in a manner contrary to the provisions of this Act, or have otherwise been lost, or unlawfully used, the Surgeon General shall afford such person a hearing on his complaint. If the Surgeon General, after notice and hearing to the State charged with the improper expenditure or loss, upon either complaint filed by any person or upon the Surgeon General's own complaint, finds that any portion of the funds appropriated under this Act have been expended by any State in a manner contrary to the provisions of this Act, or have otherwise been lost, or unlawfully used, an equal amount shall, after reasonable notice, be withheld from subsequent payments to any such State unless such amount is replaced by such State and expended for the purposes originally intended: *Provided*, That the State health officer shall have the right to appeal, within thirty days, from the decision of the Surgeon General to withhold funds to a United States district court, and such court shall have jurisdiction as to both fact and law. Any person who has filed a complaint before the Surgeon General pursuant to this section shall likewise have the right to appeal, within thirty days, from the decision of the Surgeon General not to withhold funds to a United States district court. If the Surgeon General fails to provide a hearing on a complaint within three months after it has been filed with him or fails to issue a decision within six months after the close of the hearing on such complaint, the person who filed such a complaint may file a suit in a United States district court, which shall then try the case de novo. In either an appeal from a decision of the Surgeon General not to withhold funds or a trial de novo of a suit after the Surgeon General has failed to proceed to a decision within the time specified, if the court finds that any portion of the funds appropriated under this Act have been expended by any State in a manner contrary to the provisions of this Act or have otherwise been lost or unlawfully used, the court shall direct the Surgeon General to withhold an equal amount from subsequent payments unless such amount is replaced by such State and expended for the purposes originally intended.

(3) On page 7, line 7, after the comma following the word "States," add the following:

one of whom shall be a member of any group or groups separate by law from the rest of the population and

May I, in conclusion, thank Senator Pepper and the distinguished members of his committee for permitting me to appear before them to discuss and make recommendations on this important legislation on my own behalf as an educator and on behalf of the National Dental Association.

THE CHAIRMAN: Dean Dixon, I am sorry I didn't get to hear all of your statement. I have glanced at it and heard a considerable

part of it. We thank you very much for coming.

You are correct in pointing out that 1099 does not attempt to solve the problem of dental care and facilities for the people. It is intended as an approach to the problem, in the hope that it will make a valuable contribution. The difficult and challenging problem of how we are going to provide medical and dental care for the people of the country, in a way that will be consistent with the dignity and the independence of the profession and not out of accord with the traditions of the country, is one of the most challenging problems facing the Government and the profession and the people today. This committee has been wrestling with it. We have taken a lot of testimony. The mouth and the teeth are a part of the body, and when you get around eventually to the problem of providing medical care, you must provide dental care as a part of medical care, because everyone would agree that dental care is essential to good health.

We certainly want the continued cooperation of the profession in trying to find some way by which the people of this country can get to go to dentists and be able to make payments within their means, and which at the same time will give the dentists the independence they seek in the practice of their profession and not retard professional excellence and skill.

I want to say this: If there is any way to find a voluntary method by which medical and dental facilities and care shall be made available to the people, we are going to find it if it lies within our ability. If we can't find a voluntary method that will accomplish those results with reasonable acceleration, we will have no alternative save to leave the situation as it is or go to the compulsory system. I have tried to stay away from the compulsory system, but if we don't find a voluntary method that will get relatively effective results, then believing, as I do, that the people are entitled to medical and dental care individually, I have no recourse except to turn to the compulsory system. We have stayed away from it and hope we may stay away from it, but we have to find something that will work. We have tried to be honest and fair in our approach, and we do invite every possible assistance that the profession will be good enough to give us.

Have any of the Senators any further questions?

We will recess until 10 tomorrow morning in this room.

(Whereupon, at 12 noon, the committee recessed until 10 a.m., the following day, June 27, 1945.)

WEDNESDAY, JUNE 27, 1945

The hearing was called to order at 10:05 a.m., in room 424, Senate Office Building, pursuant to adjournment on June 26, 1945, Senator Claude Pepper, Florida (chairman), presiding.

Present: Senators Claude Pepper, Florida; Robert M. La Follette, Jr., Wisconsin; George D. Aiken, Vermont.

Also present: Mr. Charles Kramer, staff director, and Mr. Carl Malmberg, chief investigator, Subcommittee on Wartime Health and Education.

THE CHAIRMAN: The committee will come to order, and we will resume our hearings. The first witness is Dr. Sterling V. Mead, of Washington, D. C., President Elect of the American Dental Association.

Doctor, we will welcome your statement. I am sorry I missed your appearance yesterday. This morning I am going to miss going out to meet all our returning delegates from the Foreign Relations Committee, which I am reluctant to do, and yet I do not want to miss this important hearing. You have been very indulgent and kind. I just want you to know that our delegates are coming back this morning. They are arriving at 10:50. The Foreign Relations Committee is now gathering in Mr. Biffle's office to go out and greet them. But if we can save somebody a toothache, maybe it will be a greater contribution to the future than going out to the airport, so we will hear Dr. Mead.

TESTIMONY OF DR. STERLING V. MEAD, PRESIDENT ELECT, AMERICAN DENTAL ASSOCIATION.

DR. MEAD: Thank you, sir.

I appear as President Elect of the American Dental Association in support of two bills: the research bill, about which we talked yesterday—and the record is complete as far as the American Dental Association's testimony is concerned with that—and we now talk this morning about the dental health bill.

The American Dental Association has had, for a number of years, a plan for dental care—dental health care. Yesterday I presented this plan: "A dental health program for the United States," for the record.

We find that our program is best set up with different aspects. The research, of course, is very important. Dental care is most important. They are interrelated definitely, and one cannot well go along without the other. We are interested especially in dental education also as that is an integral part of the plan, and we are interested especially in the program for the care of children's teeth as a practical and immediate program.

This is a long-range program and we like particularly the statement yesterday of the Surgeon General covering both bills, where he pointed out that this plan of dental care was applicable because it enabled him to go along carefully and not jump out over his head immediately on a program.

(To be continued)

THE JOURNAL *of the*
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Harold Hillenbrand, D.D.S., Editor
L. Pierce Anthony, D.D.S., Editor Emeritus

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STRIKE DELAYS THE JOURNAL

This issue of THE JOURNAL arrives late in the offices of subscribers. A city-wide strike of composing room employes has made it impossible to publish THE JOURNAL on its usual schedule. This delay, although quite unavoidable, is regretted. Every effort will be made to return to previous publishing schedules as soon as possible so that THE JOURNAL will again arrive promptly. Accordingly, the October 15 issue of the Mid-Monthly has been eliminated and the regular issues of THE JOURNAL for November 1 and December 1 have been combined. The December 15 issue of the Mid-Monthly will appear on schedule and will conclude Volume 32.

THE SUPPLY OF DENTAL STUDENTS

The number of freshmen now enrolled in the dental schools of the country is less than one-half of the number enrolled one year ago. A recent survey[1] by the Council on Dental Education of the American Dental Association reveals that approximately 1,197 freshmen were enrolled October 15 of this year as compared with 2,496 enrolled at the same time last year. This situation is the direct result of a persistently short-sighted policy on the part of official government agencies which had it in their power to anticipate and correct it before it had reached its present, serious proportions.

The necessity for a full complement of students in the dental schools has long been obvious to any one interested in maintaining, to say nothing of improving, present standards of dental health. The Council on Dental Education, the War Service and Postwar Planning Committee and other agencies of the American Dental Association have consistently and vigorously urged the need for a program under which this objective could be reached. These requests were largely ignored throughout the war by the War and the Navy Departments. The end of the conflict apparently has brought about no material change in the situation.

1. See page 1464.

Under a program[2] announced by Federal Security Administrator Paul V. McNutt, a goal of 4,000 predental and dental students was established for school courses beginning this fall. The students were to be obtained from among those discharged by the armed forces. The rate of discharge and the lack of educational qualifications on the part of the returning veterans predicted the failure of this program. This failure is now obvious, and there is no new program to meet an increasingly serious situation.

For the first decade in a hundred years, the proportion of dentists to population decreased between 1930 and 1940. In 1840, there was one dentist to 14,224 persons. In 1930, there was one dentist to 1,728 persons, and the favorable proportion had developed in a steadily increasing upward curve. In 1940, however, there was one dentist for 1,865 persons, and all present signs point to a ratio of one dentist for 2,000 persons by 1950. The full importance of this problem is seen only when this decreasing dental population is matched against an increasing national population and an increase in the demand for dental care. From 1937 to 1943, there was evidence that this imbalance would be lessened. In those years, the total enrollment in dental schools rose from 7,184 to 9,014, the highest total enrollment since 1918. This progress now has been interrupted, partly by the inescapable necessities of war and partly by the unrealistic policies of the Army and the Navy.

The hope of salvage in this situation lies in prompt and effective action by the proper agencies. Essential military replacements can be secured from those inductees who are not qualified for the study of dentistry. Men who are now on duty and who are qualified to pursue courses in predental and dental schools should be returned as soon as possible. In this way, the serious deficit of dental personnel that now faces the country can be materially lessened.

THE DENTAL OFFICERS RETURN

Although the speed of demobilizing dental officers still leaves something to be desired and the apparent absence of a logical discharge program is disturbing, dental officers are gradually being returned to their civilian practices. There is considerable hope that this process will be speeded up under pressure from Congress and under steadily diminishing military needs.

In order to inform dentists of the return of their colleagues, THE JOURNAL has inaugurated the publication of lists, by states, of officers discharged by the Army Dental Corps. The Navy Dental Corps is not making this useful information available on the highly tenuous grounds that its lists would not be up to date. It is to be hoped that the Navy Dental Corps will immediately devote its most diligent efforts to the perfection of its administrative machinery so that this final service can be rendered to veteran dental officers and their state and local dental societies. If the voluminous amount of paper work demanded of dental officers in wartime is any indication, it would seem to be a superlatively easy task for such an efficiency-bound agency to prepare these lists and make them available promptly.

Dentists in the armed forces have, quite naturally, viewed their reestablishment in civilian practice with considerable questioning. They have had a normal suspicion of short memories after long-awaited crisis has been reached and successfully passed. They have sacrificed much and earned every right to assistance from the

2. J.A.D.A. 32:1317, October 1, 1945.

public and the profession. It is not a fact, however, that their colleagues and their dental societies have been unaware of the problem that the returning dental officer will face. It is not a fact that nothing has been done by any one to aid the dental officer after his discharge. A reading of almost any dental journal will indicate that dentists and dental societies have given their thoughtful attention to these problems and that, in many areas, definite programs of assistance are in operation. The test of these programs comes now—not in the fine rhetorical phrases in which they are couched—but in their operation under terms of hard practicality.

In many communities, dentists have kept records of new patients who have had to seek service elsewhere upon the entry of their dentists into the armed forces. Now that these dentists are returning, every possible means should be used to urge patients to return to their former practitioners. This is one of the first tasks which every dentist can assign to himself in discharging an elementary obligation to the colleague who has served his country.

The shortage of adequate office space in some areas has reached serious proportions. Dentists, as well as state and local dental societies, should use their influence to develop new office opportunities for the returning dental officer. Where necessary, suites can be shared and unused office facilities made available to the veteran until the shortage has abated. Shortages in equipment can also be remedied, often through the interested cooperation of dentists of the community.

Many states have made a survey of their needs and dental resources and this information is available to the returning dental officer who is seeking a new location or to one who is establishing himself in practice for the first time.

State and local dental society officers, as well as the officials of dental schools and state dental examining boards, have resources of information on state licensure, refresher and postgraduate courses, location opportunities and many other matters that will be of value to the returning dental officer.

None of these services, even multiplied many times, will pay the debt which every citizen owes to returning fighting men. They are, however, indicative of a wholehearted attempt on the part of many persons to do what they can to restore the erosion of heavy sacrifices made by the dental veterans of World War II.

REPORTS OF COUNCILS AND COMMITTEES

COMMITTEE ON LEGISLATION

AN OUTLINE AND ANALYSIS OF THE WAGNER-MURRAY-DINGELL BILL

The Wagner-Murray-Dingell Bill of 1945 includes an extensive program for dentistry. The bill was introduced in the Senate (S. 1050) by Robert F. Wagner, New York, and James E. Murray, Montana. In the House of Representatives, the bill (H.R. 3293) was introduced by John D. Dingell, Michigan. The bill would enlarge the benefits and extend the coverage of the social insurance program. Congressional hearings will probably be held in the near future. Dentists will be concerned chiefly with Title II of the bill, which provides personal health service benefits.

The Committee on Legislation has prepared the following outline and analysis of the bill.

The Wagner-Murray-Dingell Bill of 1945 (S. 1050 or H.R. 3293) is composed of several separate and distinct parts. An index to these parts is as follows:

1. Amendments to the present Public Health Service Act, to provide grants and loans to the states for hospital and health-center construction. (Pages 1-31.)

2. Amendments to the present Public Health Service Act to provide grants to the states for venereal disease and tuberculosis prevention, treatment and control programs. (Pages 32 to 42.)

3. Amendments to the Social Security Act to provide grants to the states for maternal and child health and welfare services. (Pages 43 to 55.)

4. Amendments to the Social Security Act to provide grants to the states for assistance to needy individuals. (Pages 56 to 64.)

5. Establishment on a federal basis of a national system of public employment offices. (The present system technically consists of a coordinated state system.) (Pages 65 to 70.)

National Social Insurance System

6. Amendments to Title II of the present Social Security Act. (Pages 71 to 185.) Title II, the portion of the present law that provides for the old-age benefits, is entitled "Federal Old-Age and Survivors Insurance Benefits."

Title II will be renamed "National Social Insurance System" and the new Title II will be divided into the following eight parts:

Part A sets up a new "Prepaid Personal Health Service Insurance" system. (Pages 71 to 105.)

Part B revises the present provisions for unemployment compensation and adds temporary disability insurance benefits. (Pages 106 to 115.)

Part C revises the present provisions for retirement and survivors' insurance benefits and adds extended disability insurance benefits. (Pages 115 to 141.)

Part D creates the National Social Insurance Trust Fund. (Pages 141 to 147.)

Part E gives a special social insurance credit to men in the armed services for military service. (Pages 147 to 150.)

Part F lists the coverage provisions. (Pages 150 to 164.)

Part G levies the taxes to be collected, which are called "Social Insurance Contributions." (Pages 164 to 168.)

Part H provides for judicial review. (Pages 169 to 185.)

The following outline will treat only with the portion of the bill that establishes the Prepaid Personal Health Service Insurance System, and with such other portions as are related to it.

Persons Entitled to Benefits

The bill provides that any person who has been paid wages of, or, if self-employed, has rendered personal services (yielding), not less than $150 during the first four of the last six completed calendar quarters; or any person who is eligible for an old-age pension, or who has fulfilled other requirements, and their dependents are to be entitled to receive personal health service benefits.

The term "dependent" means an unmarried child who is under age 18 or is under a disability and not entitled to disability payments, a wife, a disabled husband who is not entitled to disability benefits or a parent who has attained age 65 if male or 60 if female and is not entitled to retirement benefits. All dependents must be living with or receiving regular support from the individual on whom they are dependent.

Exclusions

The following persons are not entitled to receive personal health service benefits:

Assistance Cases.—All assistance cases (needy individuals) are not entitled to personal health service benefits. However, any state may enter into a contract with the Surgeon General to insure assistance cases by making payments to the Trust Fund.

Unemployed Individuals and Their Dependents.—All individuals who have been unemployed for a period of twenty-seven months or more, and in some cases a shorter period, and their dependents, will not be entitled to personal health service benefits for the reason that such individuals cannot qualify as insured individuals.

Excluded Dependents.—The following dependents of insured individuals are not entitled to receive personal health service benefits:

1. All dependent unmarried children over age 18.
2. All dependent married children.
3. All dependent grandchildren.
4. All dependent nieces and nephews.
5. All dependent brothers and sisters.
6. All dependent parents under age 65 if male, or 60 if female.
7. All dependents related by marriage.

Employed Individuals and Self-Employed Individuals.—Employed individuals and self-employed individuals, who are engaged in any of the following types of employment, are exempted from the provisions of the Social Security Act and, therefore, are excluded, including their dependents, from receiving personal health service benefits.

1. Casual labor not in the course of the employer's trade or business.
2. Service performed by an individual in the employ of his son, daughter or spouse, and service performed by a child under the age of 21 in the employ of his father or mother.
3. Service on a non-American vessel outside the United States.
4. Service performed in the employ of the United States or of an instrumentality of the United States which is (a) wholly owned by the United States or (b) exempt from any social insurance contributions by virtue of any other provision of law.
5. Service performed in the employ of a state or any political subdivision thereof, or any instrumentality of any one or more of the foregoing which is wholly owned by one or more states or political subdivisions.
6. Service performed by a minister or a regular member of a religious order.

Definition of Benefits

The term "personal health service benefits" includes general medical benefits, special medical benefits, general dental benefits, special dental benefits, home-nursing benefits, laboratory benefits and hospitalization benefits.

The term "general dental benefit" means services furnished by a legally qualified dentist or by a group of such dentists, including all necessary dental services such as can be furnished by a dentist engaged in the general practice of dentistry, with or without the aid of an assistant or hygienist under his direction, and including preventive, diagnostic and therapeutic treatment, care and advice and periodic examination.

The term "special dental benefit" means necessary services, requiring special skill or experience, furnished at the office, hospital or elsewhere by a legally qualified dentist (with or without the aid of an assistant, a hygienist or an anesthetist under his direction) who is a specialist or consultant with respect to the class of service furnished, by a group of such dentists, or by a group of

dentists, including such specialists or consultants.

The terms "general medical benefit" and "special medical benefit" are substantially similar in meaning in relation to physicians, as are the terms "general dental benefit" and "special dental benefit" in relation to dentists.

Limitations on Dental Benefits

The Surgeon General, having regard for the adequacy of available personnel, may, after consultation with the Advisory Council and with the approval of the Administrator, determine for any calendar year or part thereof that general dental, special dental, or home-nursing benefit shall have such restricted content as the Surgeon General may determine; provided that, on and after January 1, 1947, the restricted content of general dental or special dental benefit shall include at least (1) examination (including an x-ray survey) and diagnosis; (2) prophylaxis; (3) extraction of teeth which are considered by the dentist and an attending physician to be, or likely to be, injurious to the general health of the individual, and (4) treatment of acute diseases of the teeth, their supporting structures and adjacent parts, including fractures of the teeth or jaws. With respect to general dental or special dental benefit, such determination may fix an age above which the restriction on content shall apply. Any restriction on the content of general dental, special dental or home-nursing benefit shall be reduced or withdrawn as rapidly as the Surgeon General finds practicable.

Administration

The bill places upon the Surgeon General of the United States Public Health Service the duty of carrying out the provisions of the act. All of his duties are to be performed under the supervision and direction of the Federal Security Administrator. The Surgeon General is also required to consult with the Advisory Council as to questions of general policy and administration.

The Surgeon General is authorized to appoint local area committees to aid him in the administration of health benefits and to make reports and recommendations to local area officers or to the Surgeon General. Such committees are to include representatives of those receiving and of those furnishing personal health service benefits. There is no provision, however, regarding either the size of these committees or the qualifications of the members, or their compensation or the term of their appointment.

The Surgeon General is authorized to transfer the administration of health service benefits to any state or local department or agency on the basis of a mutual agreement with them and he may delegate to the officers or employes of any state or local department or agency such of his powers and duties as he may consider necessary, except that of prescribing rules and regulations. He is required to give priority to the use of the facilities and services of state and local departments and agencies.

When an agreement has not been made with a state or local department or agency, the Surgeon General may carry out his duties through the United States Public Health Service, or any other federal department or agency, and he is authorized to delegate to the officers or employes of the United States Public Health Service or of any federal department or agency such of his powers and duties as he may consider necessary, except that of prescribing rules and regulations.

The Surgeon General is authorized to prescribe and publish such rules and regulations and to require such records and reports as he may consider necessary to efficient administration, except that whenever he has entered into a mutual agreement with a department or agency of the federal government or of a state government or of a political subdivision thereof, such rules and regulations shall be made by the Surgeon General after consultation with the other party to the agreement. All rules and regulations must be approved by the Federal Security Administrator.

Advisory Council

The bill creates a national advisory medical policy council called the Advisory Council, to consist of the Surgeon General and sixteen appointed members who are to be selected from panels of names submitted by professional and other agencies. The sixteen members of the Advisory Council are to be appointed by the Surgeon General, subject to the approval of the Federal Security Administrator.

The duty of the Advisory Council is to

advise the Surgeon General with reference to questions of general policy and administration, including professional standards, designation of specialists, methods to stimulate the attainment of high standards through the coordination of professional and other services, standards for hospitals, methods of payment, grants-in-aid for professional education and research projects and the making of studies and surveys.

The Advisory Council is authorized to establish special advisory, technical, regional or local committees to advise upon professional and technical subjects and questions concerning administration.

Agreements with Practitioners, Free Choice and Panel Lists

The Surgeon General is authorized to purchase whatever supplies and commodities are necessary and to enter into agreements with dentists, physicians, nurses and hospitals to furnish their respective services.

All dentists, physicians or nurses who are legally qualified in a state are also qualified to furnish their respective professional services, except in the case of specialists. Every individual is to be entitled to the free choice of a practitioner, subject to the consent of the practitioner. Every such individual and every group of such individuals are to be permitted to make such selection through a representative of his or their own choosing and to change such selection. However, the Surgeon General may prescribe maximum limits to the number of patients per practitioner and these limits need not be nationally uniform.

The Surgeon General is required to publish in each local area a list of the practitioners who have agreed to furnish health services in that area. These lists shall include both general practitioners and specialists.

Specialists

The Surgeon General is to designate specialists and to prescribe general standards regarding specialists, and in so doing he is required to utilize the standards developed by competent professional agencies. A specialist will ordinarily be available only upon the advice of a general practitioner.

Payments to Practitioners

Payments to general practitioners may be made by fee schedule, per capita, or salary, either whole-time or part-time, or any combination of these methods which the Surgeon General may approve; according in each local area as the majority of the general practitioners in each profession shall elect, except that the Surgeon General may make payments by another method to the general practitioners who do not elect the method of the majority. Similar payments may be made to specialists, including payment on a per session basis, as the Surgeon General and the specialists may agree. Payments for services need not be nationally uniform and may be adapted to regional or local conditions.

In any local area where practitioners are paid only on a per capita basis, the Surgeon General shall make per capita payments on a pro rata basis among such practitioners for all those individuals who have failed to select a practitioner or who have been refused by a practitioner.

In each local area, the practitioners are made collectively responsible for the furnishing of health benefits to the beneficiaries in that area.

Hospitals

The Surgeon General is authorized to prescribe standards concerning hospitals and to publish a list of participating hospitals. There is a further provision that the Surgeon General shall exercise no supervision or control over a participating hospital nor shall he prescribe its administration, personnel or operation as a requirement for participation.

The maximum number of days of hospital benefit in any year shall be sixty days, except that the Surgeon General may increase it to one hundred and twenty days if sufficient funds are available.

Hospitalization for mental or nervous diseases or for tuberculosis is excluded from the hospital benefit.

Grants-in-Aid

The Bill provides that a fund equal to 1 per cent of all Social Security benefits, or equal to 2 per cent of the personal health service benefits, whichever is the lesser, shall be available to the Surgeon General to be used for grants-in-aid to nonprofit institutions and agencies for research or professional education.

Hearings

The Surgeon General is authorized to conduct such investigations as he may deem necessary and to establish hearing bodies to hear complaints. He may administer oaths, examine witnesses and receive evidence, even though such evidence may not be admissible under the rules of evidence applicable to court procedure. He has the power to issue subpenas requiring the attendance and testimony of witnesses and the production of any evidence that relates to any matter under investigation.

Penalties to Prevent Abuses

The Surgeon General may determine that every individual may be required to pay a fee to his dentist, physician or nurse for the first or for each service in a period of sickness or course of treatment. Such determination shall be made only when it is necessary to prevent or reduce abuses. The Surgeon General may fix the maximum size of such fee at an amount estimated to be sufficient to prevent or reduce abuses and not such as to interpose a substantial financial restraint. Such fees may be limited to home calls, to office visits, or to both; a maximum may be fixed for each sickness, and the fees may vary between the various states, between communities or between urban and rural areas.

Compulsory Social Insurance Contributions

There is to be a compulsory tax on all employed individuals equal to 4 per cent of their wages, up to $3,600 per year, an additional tax equal thereto on all employers, and also a tax of 5 per cent on the market value of the services of the self-employed, up to $3,600 in any calendar year. These taxes are called "Social Insurance Contributions."

The compulsory tax collected is to be allocated to personal health service benefits in an amount equal to 1.5 per cent of the employe's wages from the employe and the same amount from the employer, making a total equal to 3 per cent of the employe's wages, and 3 per cent of the value of the services of the self-employed.

Since the self-employed are not eligible for unemployment compensation benefits or for temporary disability benefits, their contributions are set at 5 per cent of the value of their services instead of 8 per cent.—*George H. Fox, Secretary.*

COUNCIL ON DENTAL EDUCATION

GRADUATES IN THE DENTAL SCHOOLS OF THE UNITED STATES FOR THE YEAR ENDING JUNE 30, 1945

The Council on Dental Education has completed compilation of the figures showing the total number of graduates in the thirty-nine dental schools of the United States for the year from July 1, 1944 to June 30, 1945. The number is 3,212, the highest since 1924. This unusual number is due to the accumulated effect of the accelerated program in the schools.

Under normal conditions, the number of graduates was 1,784 in 1942. This number increased to 1,926 in 1943 and to 2,470 in 1944. We have now passed the peak of the increased output due to the accelerated plan. It is expected that the great majority of the schools will go back to the conventional procedure as speedily as is practicable. The number of graduates annually will now gradually decrease until the full effect of the present low enrollment of freshmen is felt, three or four years hence.

Table 1.—Graduates of Dental Schools in the United States for the Year Ending June 30, 1945

School	Predental College Training						Total	Per Cent with Degree	Number Graduating in Combined Courses
	Less Than Two Years	Two Years	Three Years	Four Years Without Degree	Bachelor's Degree	Other Degree			
Physicians & Surgeons	.....	23	13	1	5	1	43	14	12
California	.....	28	3	1	13	.....	45	29	45
Southern California	.....	139	11	3	16	4	173	12	48
Georgetown	.....	41	19	7	30	.....	97	31	0
Howard	.....	2	5	.....	12	.....	19	63	0
Emory	.....	106	25	1	37	.....	169	22	0
Loyola-Chicago	.....	45	15	5	21	1	87	25	0
Northwestern	.....	46	28	5	25	5	109	28	0
Illinois	.....	26	12	4	10	.....	52	19	42
Indiana	.....	14	15	5	5	.....	39	13	4
Iowa	.....	22	14	2	4	2	44	14	16
Louisville	.....	34	20	8	25	1	88	30	0
Loyola, New Orleans	.....	18	10	4	9	.....	41	22	0
Maryland	.....	84	17	1	32	.....	134	24	0
Harvard	.....	.....	.....	.....	.....	.....	0	.....	.....
Tufts	.....	69	44	4	36	7	160	27	0
Detroit	.....	18	6	1	8	.....	33	24	2
Michigan	.....	29	19	3	8	2	61	16	3
Minnesota	.....	54	18	3	5	.....	80	6	0
Kansas City	.....	52	21	3	20	1	97	22	6
St. Louis	.....	53	35	3	31	.....	122	25	0
Washington	.....	17	3	4	9	.....	33	27	0
Creighton	1	33	13	1	7	.....	55	13	6
Nebraska	.....	21	5	.....	1	1	28	7	22
Columbia	.....	.....	15	1	75	4	95	83	6
New York	.....	19	98	8	117	11	253	51	31
Buffalo	.....	13	13	5	12	.....	43	28	0
Ohio	.....	56	19	6	28	2	111	27	0
Western Reserve	.....	26	32	6	25	1	90	29	30
North Pacific	.....	59	35	18	28	6	146	23	0
Temple	.....	63	20	6	17	.....	106	16	0
Pennsylvania	.....	86	34	1	68	4	193	37	0
Pittsburgh	.....	46	15	1	19	.....	81	23	7
Meharry	.....	3	1	.....	12	.....	16	75	0
Tennessee	.....	18	11	3	7	.....	39	18	1
Baylor	.....	33	6	2	4	1	46	11	5
Texas	.....	15	4	2	12	.....	33	36	0
Virginia	.....	17	19	5	26	.....	67	39	2
Marquette	.....	50	13	3	18	.....	84	21	4
Total	1	1,478	706	136	837	54	3,212	28	292

Table 2.—Graduates of Dental Schools in the United States for the Year Ending June 30, 1945 Under the Accelerated Plan

School	1944						1945						Total
	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	
Physicians & Surgeons				43									43
California				6				29				10	45
Southern California	96											77	173
Georgetown			56									41	97
Howard						19							19
Emory		88										81	169
Loyola-Chicago			52									35	87
Northwestern			65			4		1				39	109
Illinois						49		3					52
Indiana						38				1			39
Iowa												44	44
Louisville			43									45	88
Loyola, New Orleans								41					41
Maryland		80					2				52		134
Harvard													0
Tufts			80									80	160
Detroit											33		33
Michigan												61	61
Minnesota		75				5							80
Kansas City												97	97
St. Louis			76									46	122
Washington			33										33
Creighton			23									32	55
Nebraska		28											28
Columbia			50									45	95
New York			129			1						123	253
Buffalo											43		43
Ohio			44			10						57	111
Western Reserve			45									45	90
North Pacific				42								104	146
Temple										106			106
Pennsylvania			95						4			94	193
Pittsburgh							81						81
Meharry						16	*						16
Tennessee			22									17	39
Baylor					46								46
Texas			33										33
Virginia			30			2						35	67
Marquette				2		1						81	84
Total	96	271	876	93	46	145	83	74	4	107	128	1,289	3,212

FRESHMAN ENROLLMENT IN DENTAL SCHOOLS

The Council on Dental Education has compiled the accompanying table which shows the current freshman enrollment in dental schools for 1945 as compared with the freshman enrollment as of October 15, 1944. The figures for 1945 are in part based on estimates in the schools where registration has not yet been completed, but it is believed that they present the true situation. The total freshman enrollment October 15, 1944, was 2,496. On October 15, 1945, it was 1,197, or less than half of what it was last year.—*Harlan H. Horner, Secretary.*

Freshman Enrollment in Dental Schools in 1945 as Compared with 1944

School	October 15, 1944	Current Enrollment 1945	
	Number	Date of Admission	Number
Physicians & Surgeons	48	10-11-45	25
University of California	51	10-25-45	30
University of Southern California	127	3-12-45	39
Georgetown University	59	9- 7-45	20
Howard University	52	9-29-45	28
Emory University	73	7- 2-45	31
Loyola University—Chicago	86	10- 1-45	20
Northwestern University	77	10- 1-45	35
University of Illinois	61	10- 1-45	30
Indiana University	51	9- 4-45	21
State University of Iowa	31	9-24-45	15
University of Louisville	56	7-11-45	14
Loyola University—New Orleans	48	10- 8-45	25
University of Maryland	84	10- 1-45	35
Harvard University	15	9-24-45	15
Tufts College	81	9-19-45	40
University of Detroit	31	10- 1-45	20
University of Michigan	60	10-29-45	35
University of Minnesota	78	10- 1-45	25
University of Kansas City	93	10- 1-45	35
St. Louis University	149	7- 2-45	17
Washington University	41	9-24-45	18
Creighton University	18	9-28-45	6
University of Nebraska	30	9-20-45	12
Columbia University	45	10- 1-45	40
New York University	153	7- 5-45	139
University of Buffalo	53	10- 1-45	25
Ohio State University	51	10- 2-45	30
Western Reserve University	68	9-17-45	29
University of Oregon	42	7- 6-45	29
Temple University	91	9-17-45	90
University of Pennsylvania	118	9-24-45	50
University of Pittsburgh	96	10- 1-45	50
Meharry Medical College	32	9-27-45	20
University of Tennessee	23	7- 2-45	22
Baylor University	54	9-27-45	20
University of Texas	40	9-17-45	25
Medical College of Virginia	40	9-27-45	16
Marquette University	90	7- 1-45	21
Total	2,496		1,197

COUNCIL ON DENTAL THERAPEUTICS

"PY"—NOT ACCEPTABLE FOR A.D.R.

The following report, which has been authorized for publication by the Council on Dental Therapeutics, was sent to the firm on July 27, 1945. The firm replied on August 9, 1945, enclosing photostatic copies of favorable testimonial letters from dentists and lay persons and asking to be allowed until September 1, 1945 to accumulate scientific evidence to support claims made for "PY". No further communication had been received from the firm at the time that this report was submitted to the Editor for publication in THE JOURNAL.—*Donald A. Wallace, Secretary.*

Several dentists in Alabama have written to the Council on Dental Therapeutics protesting against "PY", a dentifrice which has been advertised over radio stations WSGN and WSFA in Alabama.

The label of the product states that it ". . . may be used in the treatment of Tender, Bleeding Gums, and Gingivitis, which may lead to Vincent's Disease (trench mouth) and Pyorrhea. Used and prescribed by Dentists since 1936."

According to the label, the product contains "Acid Tartaric, Potassium Bitartrate, Saccharin Sodium and Sodium Bicarbonate."

The directions for use read: "Use daily after brushing the teeth and do not rinse the mouth after using. Take bottle cap full dry in the mouth and work well through the teeth allowing it to reach all recesses of the mouth. Hold in mouth until thoroughly dissolved or, may be applied with a damp tooth brush."

The radio commercial announcements carry the following objectionable statements:

"Py . . . has been giving quick, permanent relief for more than eight years to thousands of sufferers of pyorrhea. Many dentists now prescribe Py regularly and use it in their office practice." "Some of us have Pyorrhea and do not know it. The first sign is irritated, tender gums. Then the gums slowly recede from the teeth that are infected by Pyorrhea . . . and one by one the teeth become loose. Even in such advanced cases, PY (spelled P-Y) for Pyorrhea . . . if used three times a day . . . will remove the infection . . . nature will rebuild the tissues . . . and your teeth will be healthy and tight." "Dental authorities say 'Remove the cause and Nature will rebuild the tissues.' That's exactly what PY does! It penetrates quickly to the tender gum tissues and neutralizes the infection . . . so that Nature can rebuild the tissues which make your teeth firm and healthy."

" 'Recently one of the worst cases of Pyorrhea came to my office and I frankly told the lady there was nothing I could do but extract all her teeth,' writes a Birmingham dentist. 'Of course this did not make her feel good so I gave her a bottle of PY and asked her to use it. When she came back a week later I could hardly believe it was the same case as there was a 50% improvement in her condition. I started treating her and tamped PY down in the pockets. Within 30 days the pockets had almost filled up, her teeth were tight and her gums healthy.' "

There is nothing in the statement of composition for "PY" which would indicate that its use would have the results stated in the foregoing advertising. The advertising gives the impression that a great number of dentists use and prescribe such products for the treatment of pyorrhea and that the skill of the dentist is a negligible factor in the therapy

of Vincent's infection and pyorrhea. The bad effect which such statements, broadcast to the public, may have on the public health is incalculable.

The safety of the product when used according to the directions on the label has not been established. There is some reason to suspect that the free acid which it contains might not be completely neutralized before it could attack the exposed tooth structure.

Since there is no reason to suppose that "PY" has the virtues claimed for it in the labeling and advertising, and since it has not been shown to be harmless under conditions of use called for on the label, it is declared unacceptable for A.D.R.

NEWS OF DENTISTRY

Council on Dental Education Suspends Columbia University

The Council on Dental Education of the American Dental Association has suspended the School of Dental and Oral Surgery of Columbia University, New York City, as a result of the university's action in "integrating" the medical and dental faculties.[1] The action was taken by the Council at its meeting in Chicago, October 19-21.

The suspension of Columbia was made in accordance with the following proviso of the Council:

> If a school for the study of dentistry which has been approved by the Council on Dental Education undergoes fundamental changes in its administrative organization, university relationships, curriculum plans, faculty organization, instructional program or stated objectives, approval shall be suspended until such time as the Council may again appraise the institution in terms of its policies and criteria.

Columbia, in February of this year, announced the plan for the merger of the faculties of dentistry and medicine. The reason given for the proposed merger was that there was a close parallel between training requirements for dentistry and for general medicine. Although the alumni group and nearly every major dental association in the state protested the program, it was made effective July 1, 1945. Under the new program the School of Dental and Oral Surgery becomes a part of the Faculty of Medicine of Columbia University. The administrative officer of the dental school has the rank of associate dean for dental and oral surgery in the Faculty of Medicine.

1. J.A.D.A. 32:1150, September 1, 1945.

Educational Benefits to Begin While Officer Is on Terminal Leave

A bill, S. 1525, to permit officers to begin educational courses while on terminal leave has been introduced in the Senate by William F. Knowland, California. The bill, which was introduced October 26, proposes to amend the G.I. Bill of Rights so that complete discharge from the services will not be necessary in order to receive the educational benefits provided by the G.I. Bill. The present provision is that educational benefits are to be limited to those who have been discharged under conditions other than dishonorable.

The new bill applies only to educational benefits. In order to become eligible for other benefits, the veteran will still require his discharge papers.

Board of Trustees Votes to Hold Next Annual Meeting in 1946

The Board of Trustees of the American Dental Association, meeting at the Central Office, Chicago, October 19-21, voted to hold the next annual scientific session and meeting of the House of Delegates between June and November of next year. Announcement of the time and place will be made as soon as a survey of convention facilities in several cities is completed.

A full report of the three-day session of the Board will appear in a later issue of THE JOURNAL.

New Bill Provides for Prompt Discharge of Dental Officers

A bill "to provide for the prompt discharge or release from active duty of certain physicians, dentists and veterinarians serving in the armed forces" was introduced in the House of Representatives October 18 by Rep. Philip Traynor, Delaware. The bill, H.R. 4425, was referred to the Committee on Military Affairs. The text of the bill follows:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there shall be discharged from, or released from active duty in, the military and naval forces of the United States, as rapidly as discharge facilities will permit, every commissioned officer (other than commissioned officers of the Regular Military and Naval Establishments) serving in the Medical Corps, Dental Corps, or Veterinary Corps of the Army, in the Medical Corps of the Navy, or in the Naval Dental Corps, who—

(a) has attained on the date of enactment of this Act or shall hereafter attain the age of thirty-six years and whose active service has been of a duration of two years or more since September 16, 1940;

(b) has performed active service outside the continental limits of the United States or in Alaska for one year or more since September 16, 1940; or

(c) during World War II, was for thirty days or more in the hands of the enemy as a prisoner of war.

Plan Announced for Selection of Dental Officers for Regular Army

The War Department has announced a program under which dental officers may indicate their interest in obtaining commissions in the Regular Army. The statement setting forth the conditions under which commissions will be granted follows:

According to War Department Circular No. 243, August 10, 1945, a number of outstanding officers who have proved their capabilities in this emergency will be needed in the Regular Army peacetime establishment. The plan for selecting and integrating officers into the Regular Army, as well as the size and composition of each corps, will be determined by Congress. The War Department will recommend that those officers integrated into the Regular Army shall be of such age and physical condition as will permit them to serve for a reasonably long period prior to being retired. No officer will be appointed in a grade higher than that which he held in wartime.

It is desired now that officers who have served in the emergency, whether or not they are still on active duty, be given the opportunity of indicating their interest in obtaining a Regular Army Commission. An officer making such a statement of interest may go off active duty or remain in the service without prejudice to his chances of being tendered a commission when legislation is enacted.

Statement of Interest.—a. Officers on duty interested in being considered for commission in the Regular Army, following enactment of appropriate legislation, will submit a "statement of interest" in letter form, in duplicate, to their immediate commanding officer.

b. Officers and former officers, other than retired, who have served since December 7, 1941, and who have been relieved from active duty under honorable conditions may submit a "statement of interest" in letter form direct to the Adjutant General, Washington 25, D. C.

Economics Committee Meets with Veterans Administration Dental Chief

Proposals of the Veterans Administration for revision of its dental fee schedule were discussed in detail during a meeting of the Committee on Economics on October 19. The committee suggested further changes and adjustments to Dr. Milburn M. Fowler, Chief of the Dental Division of the Veterans Administration. These suggestions will be the basis for a later meeting at which final action will be taken.

Committee members attending the meeting, held at the Central Office of the American Dental Association, included Leslie M. FitzGerald, chairman, Dubuque, Iowa; James L. Hanley, vice-chairman, East Orange, N. J.; R. M. Walls, member of the Executive Board, Bethlehem, Pa.; Herbert E. King, Omaha, Nebr.; M. Webster Prince, Detroit, Mich.; J. B. Zielinski, Chicago, Ill. Others in attendance at the meeting included L. M. Cruttenden, chairman of the Veterans Administration Committee of the Council on Dental Health of the American Dental Association; Allen O. Gruebbel, executive secretary of the Council on Dental Health; E. C. Wetzel, chairman of the Socio-Economics Committee of the Wisconsin State Dental Society, and Kenneth F. Crane, executive secretary of the Wisconsin State Dental Society.

Army to Promote Reserve Officers on Terminal Leave

Qualified officers of the Army Reserve, up to but not including colonels, who have not received a promotion while on active duty will be promoted to the next higher grade at separation centers as they go on terminal leave, according to a recent announcement from the War Department. These officers must have served at least two years in their present grade since September 16, 1940, to be eligible for the promotion. The War Department announcement reads:

"These promotions are in the nature of a reward for services already rendered. This is a departure from the established policy of providing rank commensurate with the responsibilities assumed by an officer. It is designated to rectify any possible injustice that may have been done owing to assignments held by officers. The possibilities for promotion may not have always been equal in all types of positions and an excellent officer may, owing to his value in a particular assignment, not have had the opportunity for reassignment to a position which could carry a higher grade."

The provision covers officers who are members of the National Guard, the Organized Reserve Corps and those who have been commissioned only in the Army of the United States during the war.

By receiving the promotion just prior to going on terminal leave, the officers will wear the new insignia of rank at any time during terminal leave when they wear the uniform.

At the end of their terminal leave, the officers who request and receive a commission in the Organized Reserve Corps will revert to inactive status with the new rank on the reserve rolls subject to recall to active duty in that rank in the event of an emergency.

Those officers already placed on inactive duty status who were not promoted while on active duty and who are qualified under the new order will also be promoted. In the case of Reserve or Army of the United States Officers, they will be tendered an appointment in the Organized Reserve Corps. A National Guard officer may be appointed in the Organized Reserve Corps, if he so elects. However, there will be an automatic termination of his National Guard of the United States commission, since he cannot occupy a dual status. He may accept a commission in the Army of the United States, should he prefer, since this will not require him to vacate his National Guard commission. His Army of the United States commission, however, is temporary and terminates automatically at the end of the emergency plus six months.

Officers who are at present on an inactive status will be notified by the War Depart-

ment of their eligibility for these higher commissions. Should any officer who believes that he is qualified fail to be so notified by January 1, 1946, he may inquire of the Adjutant General, Washington, D. C., as to his eligibility.

Local Boards May Defer Dental Students Between 18 and 26

Dental students between the ages of 18 and 26 may now be deferred by local boards in order to continue their studies, according to an announcement October 30 by Col. Carlton S. Dargusch, Deputy Director of the Selective Service System. The announcement was made as the result of an inquiry from C. Willard Camalier, chairman of the War Service and Postwar Planning Committee of the American Dental Association. The text follows:

Bona fide students of dentistry who have passed their eighteenth birthday and have not attained their twenty-sixth birthday may be given consideration for deferment when the local board determines that they are pursuing a full-time course of study in dentistry and that they had completed a satisfactory pre-professional course prior to beginning the study of dentistry.

Students of dentistry to be given consideration for deferment *will not be required to attend a dental school which has an accelerated course. The deferment may be continued through the normal vacation period.*

Army Dental Corps Lists New Promotions

Twelve Army Dental Corps officers have recently been promoted to the next higher grade. Three have been advanced from lieutenant colonel to colonel. Eight have been promoted from major to lieutenant colonel and one has risen from captain to major. Those promoted to the rank of colonel were Casey Childs, on duty at the 51st General Hospital, Albert Fields, and Henry J. Toomey, on duty at the 4th General Hospital. Majors promoted to the rank of lieutenant colonel were Don F. Conger, 173d General Hospital; Theodore E. Fischer, 231st General Hospital; George S. McClench, Headquarters 15th Air Force; Charles K. Reger, 313th General Hospital; William B. Lee, 30th General Hospital; Dean J. Van Patter, 312th General Hospital; Thomas G. Fowler, 27th Station Hospital, and Harold G. Ott. Capt. Oscar J. Ogren was promoted to the rank of major.

Army Reinstates Advanced Courses Under R.O.T.C.

According to a recent release from the War Department, the Army will again offer advanced courses under its Reserve Officers' Training Corps and plans for an "interim" program of military training embracing 129 colleges and universities as the first steps toward the development of commissioned officers for a postwar army. The R.O.T.C. advanced course had been suspended since March 1, 1943, as a result of congressional enactment of an amendment to the Selective Service Act lowering the draft age to 18 years.

The new collegiate military training program is designed especially to encourage continuation of training by veterans of World War II who are entering or returning to college.

Records of Army Dentists Reported by Dental Division

The Army Dental Corps has made 71,500,000 fillings and 2,600,000 dentures and performed 16,500,000 extractions for personnel of the Army since Pearl Harbor, according to a report by Maj. Gen. Robert H. Mills, director of the Dental Division, Office of the Surgeon General.

As a result of the dental requirements of the early Selective Service program from 1940 to 1941, which stated that the recruit should have three natural masti-

cating teeth and three serviceable opposing natural incisors, 8.8 per cent of the first 3,000,000 inductees were rejected. Dental defects were the leading cause for rejection, with eye defects second and mental and nervous defects third. The dental requirements for entrance in the Army were lowered twice in 1942 to meet the need for men in military service and, finally, the only disqualifying factors were severe jaw malformation or malignancies.

The Army Dental Corps accepted full responsibility for rehabilitating these men who could not meet the minimum dental requirements. It was found that the average dental requirements for every hundred inductees were about sixty to eighty extractions and a minimum of 240 fillings.

In addition to the rehabilitation of 1,500,000 men for the Army by use of prosthetic appliances, the Army Dental Corps is now working in cooperation with ophthalmologic services on methods of fabricating an artificial eye of synthetic resin, of which more than 5,000 have been inserted to date. The Dental Service has been active also in making, and perfecting the technic for making, plastic ears, noses and chins.

Legion of Merit Awarded to Colonel Snyder

Col. Oscar P. Snyder, chief of dental service, England General Hospital, Atlantic City, N. J., has been given the Legion of Merit award, according to a recent release from the War Department. Colonel Snyder was formerly Theater Dental Surgeon in the Southwest Pacific area. His citation reads:

Col. Oscar P. Snyder, Dental Corps, United States Army, for exceptionally meritorious conduct in the performance of outstanding services in the Southwest Pacific Area from April 12, 1942 to November 10, 1944. As Chief of the Dental Section, Office of the Chief Surgeon, United States Army Services of Supply, Southwest Pacific Area, Colonel Snyder organized and supervised the dental service for a major theater of war, anticipating requirements and providing essential dental materials. Through initiative and resourcefulness, he procured important and necessary supplies and equipment from Allied sources and civilian manufacturers before the routine flow of goods from the United States could be established, and attained a high degree of efficiency in the issue to dental units. His selection of men and procurement of materials were indicative of his foresight and judgment. By example and leadership, Colonel Snyder contributed immeasurably to the efficiency of the service and the dental health of the troops throughout the entire Southwest Pacific.

First List of Army Dental Corps Officers Relieved from Active Duty

With this issue, THE JOURNAL publishes the first of a series of lists of dental officers who have been recommended for release or relieved from active duty. Other lists will be published as they are issued by the Army Dental Division, Office of the Surgeon General. No lists have been released to date by the Dental Division, Navy Bureau of Medicine and Surgery.

The list, giving the name, rank and home town of the dental officers, follows:

Dental Corps Officers Recommended for Release or Relieved from Active Duty

California

Bowers, James Parson, Lieutenant Colonel, Monrovia.

DeMartini, Loring Andrew, Captain, San Francisco.

Gatto, John Antonio, Captain, San Francisco.

Loyd, John Richard, Captain, Lindsay.

McCuen, Charles Paul, Major, Roseville.

Paaso, Sulo, Captain, Eureka.

Rozin, Sanford, Captain, Los Angeles.

Connecticut

Barnett, George T., Captain, Meriden.

Illinois

Enck, Frank Fraley, Major, Naperville.

Freedman, George, Captain, Havana.

Havey, Cyril Thomas, Captain, Carlyle.

Kelly, George Kenneth, Captain, Chicago.

Marks, Stanley Joseph, Captain, Chicago.

Puklin, Marvin Morton, Captain, Elgin.

Indiana

Kensill, John Tucker, Captain, Elkhart.

Iowa

Pfeffer, Leroy Leo, Captain, Wesley.

Stageman, James Henry, Major, Council Bluffs.

Louisiana

Gaston, Robert Woodward, Jr., Colonel, New Orleans.

Maine

Poulin, Frederick Kenneth, Lieutenant Colonel, Waterville.

Massachusetts

Despres, Leonard Alfred, Captain, Lawrence.

Minnesota

Gumbert, Carl J., Captain, St. Paul.

Mississippi

Blackburn, Estes McMath, Lieutenant Colonel, Jackson.

Easley, David Cornelius, Jr., Captain, McComb.

Stewart, Milton Monroe, Captain, Jackson.

Missouri

McDonough, Michael Patrick, Captain, Bowling Green.

Nebraska

Donley, Raymond Harold, Captain, North Platte.

Shupe, Gordon William, Captain, Royal.

New Jersey

Black, Joseph H., Captain, Fairlawn.

Hickey, Maurice John, Lieutenant Colonel, River Edge.

New York

Dolgin, Alfred A., Captain, New York.

Douglass, Crawford S., Captain, Brooklyn.

Gross, Martin Myron, First Lieutenant, Brooklyn.

Kaplan, Samuel X., Captain, Brooklyn.

Silvern, William B., Captain, Brooklyn.

North Carolina

Raymer, Jack Little, Captain, Shelby.

Ohio

Tripp, William Edward, Lieutenant Colonel, Portsmouth.

Oklahoma

Quast, Edward Christian, First Lieutenant, Alva.

Oregon

McWilliams, Elliot Williams, Major, Junction City.

Miller, Horace Metcalfe, Major, Portland.

Pennsylvania

Cantor, Harry Noah, Captain, Willow Grove.

Masino, Joseph Vincent, Major, Philadelphia.

Parsell, William Henry, Captain, Mechanicsburg.

Dental and Medical Students to Be Deferred by Draft Boards

Dental and medical students have been given special deferment consideration in a recent memorandum issued by Lewis B. Hershey, director of the Selective Service System. His recommendation to local boards was as follows:

Students in medicine, dentistry, veterinary medicine or osteopathy: Registrants ages 18 through 25 for whom a Form 42A (Special—Revised) is filed and in whose case the local board determines that they are pursuing a full time course of study in medicine, dentistry, veterinary medicine or osteopathy in a recognized school of medicine, dentistry or veterinary medicine or osteopathy until their graduation, and that they have completed a satisfactory preprofessional course prior to

their entrance, will be given special consideration, provided a student of veterinary medicine should not be considered for occupational deferment if he commenced the study of veterinary medicine in a school of veterinary medicine on or after March 15, 1945. A "satisfactory preprofessional course" shall mean such work as is ordinarily required for entrance by medical, dental, veterinary medicine and osteopathy schools of good reputation.

Percy R. Howe Receives Honorary Award of A.D.A. Patent Committee

Percy R. Howe, director of the Forsyth Dental Infirmary, has been awarded the honorary plaque which is presented annually by the American Dental Association through the Process Patent Committee. The award is given each year to an individual, living or dead, whose contributions to the advancement of dentistry are considered to deserve special recognition.

The House of Delegates, in 1943, adopted the plan to confer a suitable award annually on a member of the profession who had made valuable contributions to the field of dentistry. The award consists of a wood panel with silver mountings bearing the Association seal, a laurel wreath, the name of the recipient and an inscription. When the award is conferred upon a living person, the plaque is made in duplicate, one for the recipient, the other to be kept by the American Dental Association.

Dr. Howe is the second recipient of the Process Patent Committee's award. The first plaque was awarded posthumously to Horace Wells at the Wells Centenary Celebration in Hartford, December 11, 1944.

Percy R. Howe was born in Providence, R. I., on September 30, 1864. He received his dental degree in 1889 from the Philadelphia Dental College. After graduation, he maintained a successful practice for eight years in Lewiston, Maine, a practice distinguished for

Percy R. Howe, Boston, Mass., awarded American Dental Association plaque.

research in bacteriology, histology and chemistry as they pertained to dental practice. In 1898, he went to Boston to have closer contact with research laboratories and libraries. In 1914, when the Forsyth Dental Infirmary for Children, the first institution of its kind, was dedicated, Dr. Howe was appointed chief of the research laboratory. He has conducted his research chiefly in three distinct fields: micro-organisms of the human mouth, physiologic disturbances induced by nutritional conditions and the therapeutic treatment of dental caries.

In 1927, Dr. Howe was appointed director of the Forsyth Dental Infirmary. Under his direction, the influence of the Infirmary on dental concepts and practices has become world wide. In 1929-1930, he served as President of the American Dental Association. In 1941, he received the doctor of laws degree from Harvard University. Dr. Howe has received various other honorary medals, among them the award of the Callahan Memorial Commission, the Jarvie medal of the Dental Society of the State of New York and the Newell Sill Jenkins Medal awarded by the Connecticut State Dental Society.

Signal Corps, U. S. Army

Principals in the prosthetic dental conference held at Fort Knox, Ky., July 19-21. Left to right, Col. Frank McA. Moose, post surgeon; Col. Harold C. Percival, post dental surgeon; W. H. Wright, University of Pittsburgh; Maj. Gen. Robert H. Mills, Washington, director, Dental Division, Office of the Surgeon General; Earle E. Smith, University of Iowa; O. M. Dresen, Marquette University, Milwaukee; Col. A. P. Matthews, Chicago, Sixth Service Command dental surgeon, and Col. H. E. Albaugh, Fort Hayes, Ohio, Fifth Service Command dental surgeon.

General Mills Receives Distinguished Service Medal

Maj. Gen. Robert H. Mills, director of the Dental Division, Office of the Surgeon General, was awarded the distinguished service medal by Surg. Gen. Norman T. Kirk at a meeting of the Service Command dental surgeons in Washington, October 15. The citation to General Mills read as follows:

Maj. Gen. Robert H. Mills performed exceptionally meritorious service in a position of great responsibility as director of the Dental Division, Office of the Surgeon General, from March 1942 to September 1945. With exceptional foresight, organizing ability and leadership, he provided and maintained a superior dental service, based on sound plans and professional policies, for the millions in the Army. Under his guidance, the Army Dental Corps was expanded from several hundred to more than 15,000 officers, and dental facilities, including clinics and laboratories, were expanded proportionately. The dental rehabilitation of more than a million men accomplished under his supervision represented a tremendous contribution to the conservation of fighting manpower and to the future health of the nation. He skilfully coordinated the activities of the Dental Corps with other federal agencies and the civilian dental profession. Through his unremitting efforts to achieve exceptional standards of dental care, General Mills made a notable contribution to the war effort.

Portrait Presented to Maj. Gen. Robert H. Mills

The formal presentation of a portrait of Maj. Gen. Robert H. Mills, director, Dental Division, Surgeon General's Office, recently completed by the artist Bernard Godwin, was made by the Army Dental Corps on October 28, Sternberg Auditorium, Army Medical Center.

Limited Number of Dental Officers to Go Overseas

A limited number of dental and medical personnel must still be sent from the United States to overseas theaters to permit the return of high score individuals for separation, the War Department announced September 17. The following criteria have been established to govern the selection of dental and medical personnel for overseas service, except for volunteers: Individuals to go overseas must have a point score of below the adjusted service rating of 45, and must be under 40 years of age.

The separation criteria now in effect will probably be revised on or before the end of this year. Present plans contemplate the lowering of criteria during the first half of 1946, which will include a provision for length of service as a basis of separation of officers who came on active duty after Pearl Harbor. On the basis of a two and a half million Army, the Surgeon General will be able to release from V-E strength approximately 10,000 dentists, 30,000 Medical Corps officers and more than 40,000 nurses.

International Medical Press Plans Bibliographic Bulletin

The International Association of Medical Press, Rome, Italy, plans to issue a bibliographic bulletin in 1946 of the latest medical books published in various parts of the world. This bulletin will present a summary of information regarding all publications and will be sent without cost to editors of reviews in order to keep them posted on the literature of the health services in all countries. The association requests that authors, editors and typographers send copies of their publications or all the necessary bibliographic facts to be inserted in the bulletin. Information desired includes year of foundation, number of pages, yearly number of issues, names of editors, languages used in the text, place of publication, subscription rate, home and abroad, and types of articles that appear in the review (original works, summaries and news items). The association would appreciate the transcription of this information into Latin characters and arabic numerals, to simplify the task of compilation of the text and to give uniformity to the content. The foregoing information should be sent to the Editor, Santo Vanasia, Via Macchi 71, Milan, Italy.

Dental Supplies Sought for Relief of French

Dental supplies and equipment needed for treatment of French prisoners of war and deportees are being sought by Princess Gladys de Polignac, who has come to this country on a special mission for the French Red Cross, according to a recent *New York Times* article. Mobile dental units, 4,000,000 porcelain teeth and other dental equipment are needed to care for the 1,500,000 men repatriated in the six months following the fall of Germany, she said. Dentists who wish to donate instruments and other supplies are urged to send contributions to the Medical and Surgical Relief Committee of America, 420 Lexington Ave., New York, N. Y.

Chicago Dental Society Announces Fifth Annual Essay Competition

The Chicago Dental Society is again offering a cash prize of $500 to the author of the most deserving essay reporting an original investigation and containing new and significant material of value to dentistry. The contest is conducted annually by the society to encourage scientific research in all phases of dentistry.

The winner of the award will be invited to present his essay at the 81st Midwinter Meeting of the Chicago Dental Society, February 11-14, 1946.

Any member of the American Dental Association, or of a recognized foreign dental society, or any one affiliated with a recognized institution in the dental field may apply for entry in the competition. The contest is not limited to research men having technical staffs and elaborate equipment at their disposal, but is open to any qualified person who believes that he has something new and important to contribute to dentistry.

Honorary Fellowship Awarded to Gebhard

An honorary fellowship has recently been awarded to Bruno Gebhard, director of the Cleveland Health Museum, by the International College of Dentists, in recognition of the work that he has done through the museum in furthering dental health education.

Dental Service with a Division in the Army

The following statement describing dental service with a division in the Army during the Italian campaigns has been released by the Dental Division, Office of the Surgeon General:

The following running report tells what dental activities actually took place within a division during the Italian campaigns in 1944. It further presents some of the problems and how the various situations were met.

"On January 1, 1944, the division was in North Africa having just completed its movement overseas. As soon as possible, all unit dental officers were set up in their unit aid stations. A survey was accomplished, the results of which were as follows: Class I: None; Class ID: 75; Class II: 505; Class III: 127; Class IV: 13,028.

"The Class ID cases, those requiring prosthetic treatment, were the immediate problem. To care for these cases, one officer and two dental technicians were placed on detached service at a station hospital unit in a nearby town. During the month of January, seventy-two prosthetic cases were completed. The construction of these cases was accomplished entirely by division personnel.

"Approximately February 1, 1944, the division began its movement to Italy. The first location was a training area, where it remained from approximately February 6 to March 3, 1944.

"During this period the equipment and materials for a division dental laboratory were acquired. Frequent substitutions had to be made because of the nonavailability of certain items. For instance, a hand drill, mounted, was obtained from the division ordnance company, the shaft being cut down to fit the dental chuck. The dental lathe was not available for divisions at that time. During this period the unit dental officers accomplished routine dental care, working at their respective unit aid stations.

"On March 3, 1944, the division moved into the line. From that time until May 11, 1944, they were in a static combat situation: 'The Battle for Cassino.'

"The dental laboratory was set up in a building, while plans were made to construct a mobile dental laboratory. The body of a two and a half ton truck was procured, and the laboratory was constructed at the division ordnance company.

"On April 30, 1944, the division mobile dental laboratory was completed. The division was proud of the mobile laboratory, and as a result we had the honor of having it inspected by the II Corps and Fifth Army Commanders.

"The mobile laboratory has proved to be the only answer to the division's prosthetic problem. One officer and two enlisted dental technicians have at all times been attached for duty at the laboratory. Through their efforts, and the convenience of the mobile laboratory, the prosthetic problem has been cared for in a very satisfactory manner. The total number of cases constructed in the laboratory during the year 1944 is as follows: new dentures, 514; dentures reconstructed, 64; dentures repaired, 220; dentures rebased, 2; dentures relined, 7; bridges fixed, 17; inlays, 15. Total, 839.

"This does not include the seventy-two cases constructed by division personnel while on duty at a station hospital during the month of January 1944. These cases were credited to the station hospital report.

"Routine dental treatment was accomplished by unit dental officers during this period, 'The Battle for Cassino,' at the unit aid stations. The policy, as regards the infantry regiments, was usually to have one dental officer at the unit service company, and one at the regimental aid station. A very satisfactory amount of routine dental treatment was accomplished from March 3 to May 11, 1944. This is possible when the front is static, as it was during this period. All the dental officers were able to set up their equipment, had adequate space, light, etc., and patients were readily available.

"On May 11, 1944, the division pushed off on the 'Advance on Rome.' The division remained in combat until approximately June 10, 1944, at which time it was relieved and went into a rest area.

"The amount of routine dental treatment accomplished from May 11 to June 9, 1944, was naturally less than that of the previous period. During an advance such as this, it is almost impossible for the dental officers to set up their equipment, except possibly at the service company, and then the number of patients available is definitely limited.

"The division remained in a rest area from June 9 to July 6, 1944. During this period a satisfactory amount of routine dental treatment was again accomplished.

"On July 6, the division resumed combat in 'The Pursuit North of Rome,' and remained in combat until approximately August 1, 1944. At that time the division went into a rest and training area, where it remained until approximately September 20, 1944.

"During the period August 1 to September 20, 1944, an excellent amount of routine dental treatment was accomplished. For example, the number of restorations during this period was approximately 3,200. A dental survey was also accomplished.

"The division reentered combat on September 20, 1944, 'Battle of Approaches to Po Valley,' and remained in combat until approximately November 1, 1944, at which time each unit, with the exception of the division artillery, was given a ten-day rest period.

"During this combat period, September 21 to November 1, 1944, there was very little routine dental work accomplished. The division was always in a precarious situation, having its right flank exposed. The weather, particularly the mud, was also a definite factor, making it difficult to set up tents. The buildings were scarce, and in all it was an extremely unpleasant situation. Dental treatment during this period hit a new low. In the regiments it was confined almost entirely to emergency treatment.

"A fair amount of dental work was accomplished during the ten-day rest given each unit during November. However, it was too short a time to really accomplish anything. It takes time to set up and get into a routine. The men as well as the dental officers must have time in which to clean up, and receive a little relaxation after such a campaign as October provided. Then too, the unit is reequipping the men, receiving replacements and reorganizing. All in all, a ten-day so-called rest-period has its limitations.

"After the completion of the ten-day rest given each unit, they again returned to the front line, about November 21, 1944. The situation was a little different, however, from what it had been since May 11, 1944. The front was static, and the amount of routine dental treatment rendered was accordingly increased. The division remained in this position for the remainder of 1944.

"The dental classification at the conclusion of 1944 was as follows: Class I, 38; Class ID, 143; Class II, 1,612; Class III, 136; Class IV, 11,543."

News of Dentists and Dental Societies

California.—The Medico-Dental Study Club of San Francisco has been invited to participate in the twenty-fifth anniversary of the Guatemala Dental Society. The invitation was received by Roy D. Grant, president of the study club, from Enrique Estrada, head of the Guatemala Society.

Georgia.—Ralph R. Byrnes, dean of the school of dentistry of Emory University, Atlanta, was honored recently with a reception given by the faculty and staff of the dental school in commemoration of his twenty-fifth anniversary with the school.

Indiana.—L. M. Childers, Lafayette, has recently been appointed director of the newly created Division of Dental Health in the state health department.

Kansas.—Baldwin City, which has a population of 1,239, reports that, after five years' operation of a dental program for school children recommended by the dental division of the Kansas State Board of Health, no permanent teeth have been extracted from the mouths of 184 children in grades 1-8. Only sixteen permanent teeth were lost in the 109 high school students.

Kentucky.—Russell I. Todd, president of the Kentucky State Dental Association, was appointed a member of the Kentucky State Board of Dental Examiners by Gov. Simeon Willis May 25. Dr. Todd has also been appointed to the Professional Advisory Committee for Vocational Rehabilitation in Kentucky by the state superintendent of public instruction.

Massachusetts.—The Guild of St. Apollonia has recently received a gift of $10,000 from former Ambassador Joseph P. Kennedy. At the twenty-fifth anniversary of the guild in Boston, Archbishop Cushing extended the guild's thanks and appreciation to Ambassador Kennedy.

• Dr. Frank Carroll, at present with the Army Dental Corps, has been appointed director of the new Division of Dental Health of the Massachusetts Department of Health.

Michigan.—Kenneth A. Easlick, director of the Department of Children's Dentistry, University of Michigan, Ann Arbor, has been appointed by Gov. Harry F. Kelly to the State Advisory Council of the Michigan Department of Health for a six-year term.

Minnesota.—The death of Maj. Oscar C. Kowalske (DC), Annandale, has been reported by the Dental Division, the Office of the Surgeon General. Major Kowalske was killed December 15, 1944, when the Japanese ship on which he was being transported as a prisoner of war was sunk.

Oklahoma.—Fred Seids, Perry, has recently been appointed to the new nine-member state board of health by Gov. Robert S. Kerr.

Oregon.—Ray A. Jacobsen, Wausau, Wis., has been appointed director of the Division of Dental Health in the Oregon State Department of Health, to succeed Floyd DeCamp.

Pennsylvania.—Lester W. Burket, Philadelphia, has been appointed professor and head of the department of oral medicine at the University of Pennsylvania Dental School.

Tennessee.—J. W. Matthews, Nashville, grinds teeth as a hobby as well as as a profession. According to a recent article in the *New York Times,* Dr. Matthews has fashioned hundreds of miniatures of "everything from elephants to pin-up girls" from extracted molars. Each miniature requires about fifteen or twenty minutes for completion. The hobby, which Dr. Matthews has followed for forty years, provides amusement for his patients and gives his office the appearance of a curio shop.

• A. H. Trithart has been appointed regional dental officer for West Tennessee, according to an announcement by Carl L. Sebelius, director of the Division of Dental Health of Tennessee.

• Oren A. Oliver, Nashville, has been made an honorary life member of the Ontario Dental Association. He is the first non-Canadian to become a member of the association.

Washington.—Frank Wood, Seattle, has recently resigned his post as editor of the *Washington State Dental Journal.* Berton E. Anderson is the new editor.

CASES AND COMMENTS

Osteitis and Necrosis of Mandible Following Injections of Neo-Arsphenamine: Report of Case

Roy B. Wright, D.D.S., Oakland, Calif.

History.—A woman, aged 33, weight 109 pounds, height 5 feet 2 inches, came in with a complaint of bleeding of the gums, swelling and severe pain in the left side of the mouth. Approximately four months earlier, she had been given injections of neo-arsphenamine by her physician "for trench mouth." An exfoliative dermatitis involving the entire body followed. The phenomenon was repeated several times. There was a complete loss of hair and nails and a temporary loss of sight and hearing, with severe head pains. An interference in function of the liver, kidneys and heart occurred, accompanied by severe abdominal pains, and the patient was confined to bed for three months. Some gingival bleeding and occasional soreness were noted during that time. The patient did not seek dental care until one month after she had become ambulatory.

Oral Examination. — There was marked gingival hypertrophy, more pronounced in the left quadrants, where approximately two-thirds of the normally exposed tooth surfaces were invested. The inner surfaces of the pockets thus formed were characterized by an ulcerous condition. The bone was denuded next to the lower left cuspid and first bicuspid, which were not in normal contact.

Roentgenographic Examination. — There was an area of radiolucency centered between the lower left cuspid and the first bicuspid. A moderate vertical resorption of the crest of the alveolar ridges obtained throughout except in the left maxillary molar region, where resorption was more extensive, involving the first molar root trifurcation.

Diagnosis. — Paradentosis complicated by arsenical intoxication producing sloughing of gingival tissues was diagnosed, with denudation in the area of open contact between the lower left cuspid and the first bicuspid resulting in infection and osteomyelitis.

Treatment.—Urea peroxide was employed in the treatment of the acute gingival condition. A therapeutic intake of vitamin B complex and vitamin C was prescribed. While the gingivae responded satisfactorily,

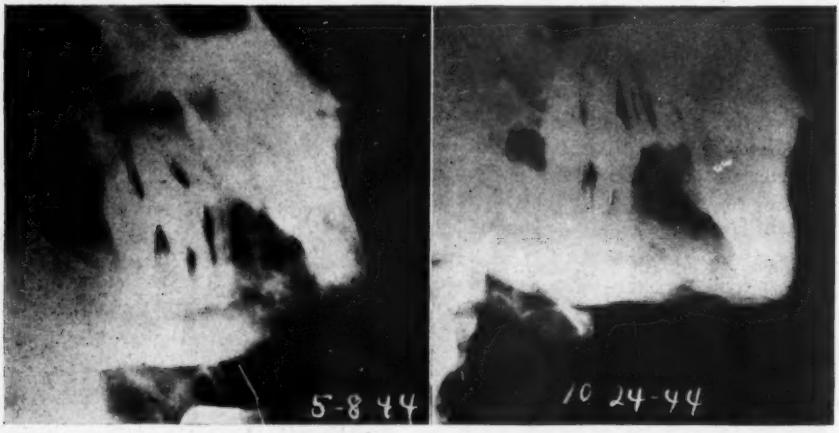


Fig. 1.—Left: Extensive necrosis of left mandibular area (roentgenogram taken just before operation). Right: Condition five months after operation; showing bone regeneration.

Fig. 2.—Left: Bone involvement starting between lower left cuspid and first bicuspid. Center: Condition five months after operation, showing loss of left incisors and cuspid. Right: Condition five months after operation mesially from mandibular first molar.

the bone became increasingly involved, except for one period when the osteomyelitis appeared to be self-limiting. Palliative treatment was instituted, surgical dressings containing zinc oxide and eugenol over the denuded bone giving relief for several hours after application. The patient was admitted to the penicillin clinic, Stanford University Hospital, as soon as practicable. Her weight was then 98 pounds. Sulfonamide therapy was followed by a flare-up of exfoliative dermatitis of generalized nature. On the fifth day, penicillin was obtained and was administered by intramuscular injection. On the sixth day, an opening was made externally along the lower border of the left anterior mandible. An involucrum was found in the form of a thin shell of bone about 0.5 cm. from and surrounding the infected area of the mandible. This involucrum was removed, as well as extensive purulent granulation tissue which lay between this shell and the mandible proper. The left mandibular incisors, cuspid and bicuspids were then extracted and sequestra removed from the medial inferior side of the mandible. The external wound was closed and the oral wound packed open. Penicillin was continued, 120,000 units daily, with a total of 1,500,000 units. The course of the infection continued to be very favorable and the patient was dismissed from the hospital on the nineteenth day.

Epicrisis.—On completion of the surgical procedures, a small amount of sulfathiazole powder was dusted into the oral wound. In about an hour, a mild skin eruption occurred, receding in about twelve hours.

Although during the nine months since operation, an occasional dermal flare-up has occurred, associated in one instance with loss of the re-formed nails, the general physical condition is good. The weight is 115. The scalp hair is 8 inches long, thick, reddish brown, soft and curly. (It was formerly very light blond and straight.) The pubic hair has not returned. The finger and toenails are well formed. Recently, alopecia areata with extensive secondary pyogenic

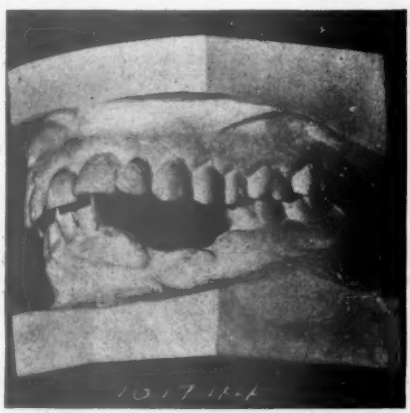


Fig. 3.—Stone models made five months after operation.

infection involving two areas each about 3 inches in diameter developed in the occipital region. The hair is returning. Inflammatory processes of the paradental tissues occur periodically, but subside readily under treatment. Recently, pockets 6 mm. in depth developed lingually from the upper left central and lateral incisors because of hypertrophy of the gingival tissues, coupled with detachment. The teeth tipped labially approximately 2 mm.

After cleansing of all sulci with urea peroxide and employment of subgingival curettage where indicated, the migrating teeth returned to the original position.

Mandibular repair is proceeding satisfactorily for accommodation of the denture saddle.

Dr. V. E. Hepp admitted the patient to the penicillin clinic, Stanford University Hospital, at a time when penicillin was extremely difficult to obtain, and operated on the mandible during the period that penicillin was being administered. Dr. S. B. Fontaine assisted as consultant.

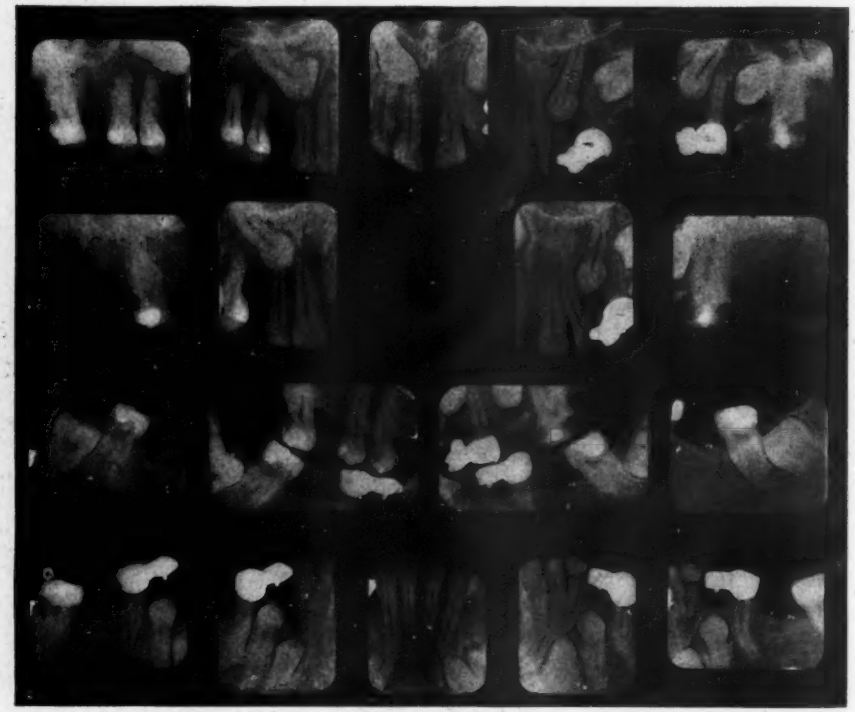
1904 Franklin Street.

Multiple Impaction: Report of Case

Rowe Smith, D.D.S., Texarkana, Texas

A woman, aged 30, came in for examination because of pain, apparently emanating from the upper lateral and first molar areas and the result of partial pulp exposures. She reported that her general health was good except for vague rheumatic pains and lack of energy, with an inability to masticate her food properly. A general physical examination was suggested.

An x-ray examination revealed impaction, or noneruption, of the upper and lower cuspids, upper left second bicuspid, lower first bicuspids and lower third molars. Apparently, bridges had been constructed without previous x-ray examination, which would have revealed the unusual number of malposed teeth.



Multiple impaction.

CURRENT LITERATURE

Use of Fibrin Foam with Thrombin in Dental Operations. Paul K. Losch. J. Oral Surg. 3:177, July 1945.

Four cases are presented in which fibrin foam and thrombin were successfully used to control postoperative hemorrhage. With a sterile technic, the dried thrombin is dissolved in an isotonic solution of sodium chloride at room temperature and delivered to a specimen dish. The dried foam, divided into desirable sizes, is then soaked in the solution. The plastic, thrombin-soaked mass can then be condensed and molded into required shapes for insertion in wounds. The thrombin solution may also be impregnated with antibacterial agents such as sulfadiazine, penicillin and tyrothricin, in concentrations as high as desired. Hemostasis is quickly effected by the presence of thrombin held in place by the fibrin matrix. Infiltration of the foam by the blood results in the formation of a relatively normal blood clot.—*R. P. Likins.*

Observations on the Teeth of Chinese Born and Reared in China and America. Gabriel W. Lasker. Am. J. Phys. Anthropol. 3:129, June 1945.

A comparison is made of dental conditions among 281 adult male Chinese in the United States and 367 Chinese male prisoners in Peking. From studies of dental caries, three conclusions are drawn: 1. Immigrants have less caries than American-born Chinese, but seem to have more caries than Chinese examined in China. 2. The occurrence of caries in immigrants varies inversely with the age at the time of migration. 3. American-born Chinese who have lived part of their lives in China have less caries than those who have never been to China.

Medium and pronounced crowding of the teeth were also found to be significantly more frequent in American-born Chinese than in immigrants. Among the immigrants, the "workmen" group show less crowding of the teeth than the student group. The Chinese overseas of Cantonese descent seem to show pronounced overbite less frequently than do persons from other regions of China. The author suggests that the selection of a genetic type rather than plasticity in the individual is probably the explanation for differences in the bite. Since there is a close correlation of attrition with age, differences in wear of the teeth are believed merely to reflect age differences. The lack of the third molars, whether congenitally absent or incompletely erupted because of impaction, is frequent among Chinese from all parts of China. This condition is said to be a characteristic mongoloid trait. Finally, in respect to shovel-shaped incisors, there is virtually no difference between the frequency in American-born and in immigrant Chinese who came to the United States after their teeth had been formed. This trait was found to be absent in only six of the 269 persons in whom the upper incisors were present.—*S. W. Leung.*

Ludwig's Angina Treated with Penicillin: Report of Case. Arthur F. Dorner and David Morgan. J. Oral Surg. 3:232, July 1945.

A case is presented in which a moribund patient ill with Ludwig's angina was revived by the use of penicillin. The patient was refractive to a short initial course of sulfadiazine. This treatment was discontinued and penicillin therapy instituted. A total of 400,000 Oxford units was given by intramuscular injection of 20,000 units each during a period of four days. After the first twelve hours, there appeared to be no progression of the disease and the patient was comfortable. Within thirty-six hours, definite improvement was observed. By the fifth day, the hard, boardlike induration had subsided. Recovery was uneventful, with complete resolution unaccompanied by suppuration.—*R. P. Likins.*

A Family with Inherited Ectodermal Dystrophy. W. D. Wilky and G. H. Stevenson. Canad. M. A. J. 53:226, 1945.

Inherited ectodermal dystrophy, transmitted as a nonsex-linked dominant factor

and characterized by alopecia with or without abnormal nail development, was found in sixty-four persons from a family of 265 representing six generations. The three types of nail defects described all were accompanied by slight deformities of the hands and fingers. The skin of the hands and fingers was rough, dry and thickened, often showing yellowish calloused areas. The scalp, facial, axillary, genital and body hair was sparse and, in some cases, absent. The eyebrows and eyelashes were correspondingly thinned. No inherited deformity of the teeth was found in any of the family. Some members of the family were of low intellectual and social status. Three of those with ectodermal defects also had a right internal strabismus. —*S. W. Leung.*

Acute and Chronic Ascorbic Acid Deficiencies in the Rhesus Monkey. J. H. Shaw, P. H. Phillips and C. A. Elvehjem. J. Nutrition 29:365, 1945.

An acute ascorbic acid deficiency produced in young Rhesus monkeys was characterized by loss of weight, tenderness of the joints and heavy residues on the tooth surfaces. When the animals were given a single test dose of ascorbic acid, these conditions were readily alleviated. A chronic state of ascorbic acid deficiency was also produced. Here, the main symptoms were represented by gingival changes, the presence of dental tartar, marked tenderness and soreness at all joints, and bone resorption at the bone-cartilage junction. Extensive loss of hair and a mild dermatitis present in these animals could be prevented or cured by administration of biotin. A high incidence of dental caries was noticed in three of the six monkeys on a chronologically deficient diet. Thus, there was a distinct difference between the signs of acute and those of chronic ascorbic acid deficiency in the Rhesus monkeys.—*Humberto Granados.*

Studies on Experimental Fluorine Poisoning in Rats. S. Ranganathan. Ind. J. M. Res. 32:233, October 1944.

Young rats weighing about 50 gm. were put on diets containing an excess of fluoride to which various calcium salts had been added, the doses of the latter being calculated on the basis of a similar intake of calcium. The criterion of protection conferred by the salt was the survival of the animals and, to a lesser extent, their growth response. The calcium salts added were lactate, gluconate, phosphate, oxide, carbonate and chloride. These salts were found to have approximately the same potency in mitigating the toxic effects of the fluorides. The effect of adding magnesium, barium and aluminum salts of elements which form insoluble fluorides was then tested. The magnesium salt alone afforded some protection though to a lesser degree than the calcium. The beneficial effects observed with these salts cannot be wholly explained as due to the mechanical removal of fluoride as insoluble, since the calcium salt administered subcutaneously was equally efficacious. Previously reported findings that feeding of fluoride with vitamin D inhibits the curative properties of the vitamin in the case of rats previously rendered rachitic were confirmed. —*J. E. Gilda.*

Use of Penicillin in Vincent's Angina. Paul L. Shallenberger, Earl R. Denny and Harold D. Pyle. J. A. M. A. 128:706, July 7, 1945.

The diagnosis of Vincent's angina was made upon certain well-defined clinical criteria and confirmed by smears taken from the ulcers. Most of the first group of thirteen patients were treated by swabbing of the involved areas three times daily with a mixture of 3 per cent chromic acid and 10 per cent silver nitrate, preceded by gargling equal parts of 50 per cent sodium perborate and 50 per cent hydrogen peroxide. A few of the patients received, in addition, and others alone, 0.03 gm. marpharsen intravenously every second or third day. A second group, of eleven patients, were treated with 1-gm. doses of sulfadiazine, used as lozenges, every four hours. Group 3 (nine patients) were treated with penicillin applied on a swab every four hours in a concentration of from 250 to 500 units per cubic centimeter. Group 4 consisted of two patients treated with penicillin administered intramuscularly. The patients in group 3 responded much more rapidly than patients on either of the two preceding régimes. One patient in group 4 responded more rapidly than any in the three other groups. It was concluded that topical application of penicillin in a concentration

of 500 units per cubic centimeter four times daily is a rapidly effective therapeutic procedure in the treatment of Vincent's angina. The intravenous method of administration warrants extended trial.—*J. E. Gilda.*

Dental Caries in the Cotton Rat. III. Effect of Different Dietary Carbohydrates on Incidence and Extent of Dental Caries. B. S. Schweigert, J. H. Shaw, P. H. Phillips and C. A. Elvehjem. J. Nutrition 29:405, 1945.

Purified diets containing different carbohydrates were fed to several groups of cotton rats in order to determine any differences in dental caries incidence among the different groups. It was found that dextrimaltose, glucose, fructose, maltose and sucrose diets gave approximately the same growth rates, while fine dextrin and stock or soluble starch rations, as compared with the sucrose control diet, produced lower growth curves. A high incidence and wide distribution of dental caries were noted in animals receiving the glucose, dextrimaltose, fructose, maltose and lactosucrose rations, while the fine or coarse dextrin diets resulted in only a low incidence of dental lesions. Replacing one-half of the sucrose with fine dextrin did not decrease the severity of caries, but the replacement of three-quarters of the sucrose with fine dextrin reduced both the incidence and the extent of the lesions to a slight degree.—*Humberto Granados.*

Effectiveness of Penicillin in the Treatment of Vincent's Angina. B. M. Schwartz. J. A. M. A. 128:704, July 7, 1945.

Fourteen cases of Vincent's angina were treated after diagnosis by clinical and laboratory methods. The tonsillar or pharyngeal lesions had the following features in varying severity and combination: hyperemia, edema, ulceration, exudation, bleeding and characteristic odor. Submaxillary lymphadenopathy and mild gingivitis were associated symptoms and all cases presented positive smears for *Borrelia vincenti.* Penicillin was injected intramuscularly, usually in 20,000 unit doses, every three hours until 100,000 units had been administered. In a few cases, a larger or smaller dose was given. In each instance, subjective discomfort was decidedly alleviated in twenty-four hours and completely eliminated in forty-eight hours. There was definite improvement within four to six hours. Ten patients had negative smears within twenty-four hours of initiation of treatment. The four remaining patients had negative smears two (two cases), three and nine days after treatment.—*J. E. Gilda.*

Reversal of Lingual Atrophic Changes with Nicotinamide Therapy. E. L. Sevringhaus and E. D. Kyhos. Arch. Int. Med. 76:31, July 1945.

Observations on an unselected group of 102 male prisoners showed that nearly one-third (thirty) had visible evidence of atrophy of the tongue, including fissures, a reduced number of filiform papillae and dental scalloping of the margin of the tongue. Treatment of twenty-three men with 50-mg. doses of nicotinamide brought about striking improvement, most nearly complete in the case of the papillae, but also noticeable in the reduction in depth of the fissures and a decrease in amount of scalloping. The application of similar therapy to three patients with fissures and atrophy of papillae, two with pernicious anemia and one with a similar anemia, but without response to liver therapy, was followed by prompt improvement, which required several months for completion. It was concluded that the criteria of chronic aniacinosis proposed by Kruse are valid.—*J. E. Gilda.*

Inhibition of Pigment Deposition in Incisor Teeth of Rats Deficient in Vitamin E from Birth. Humberto Granados and Henrik Dam. Proc. Soc. Exper. Biol. & Med. 59:295, June 1945.

Three groups of normal female rats were maintained for sixty days from their parturition on vitamin E-deficient diets containing, respectively, no fat, 20 per cent cod liver oil and 20 per cent lard. Deposition of normal pigment failed to occur in the enamel of the incisor teeth of the young of animals receiving cod liver oil and lard. A difference in the effects of ingestion of these two fats on the adipose tissue was found, only animals that received cod liver oil presenting a yellow-brown discoloration of the body fat. —*Humberto Granados.*

DEATHS

Adelsohn, Abraham, Mineola, N. Y.; died in the Pacific Area, March 10. Dr. Adelsohn was a captain in the U. S. Army Dental Corps.

Akers, Ernest F., Orlando, Fla.; died August 20.

Allen, P. W., Grove City, Pa.; University of Pittsburgh, School of Dentistry, 1918; died September 14; aged 51.

Altman, Dayton Stokes, Mullins, S. C.; Atlanta Dental College, 1912; died September 7; aged 57.

Anderson, Claude R., Houston, Texas; died July 9; aged 60.

Anger, Hiram W., Victor, Iowa; State University of Iowa, College of Dentistry, 1892; died September 4; aged 77.

Austin, Charles E., Toronto, Ont.; Chicago College of Dental Surgery, Dental Department of Loyola University, 1897; died September 15.

Baldwin, Clayton R., Perry, Ohio; Western Reserve University, School of Dentistry, 1897; died September 10; aged 70.

Barnard, Francis H., Jr., Duluth, Minn.; Harvard University Dental School, 1896; died in July; aged 70.

Bell, Carlton John, Little Chute, Wis.; died July 6.

Bondy, R. F., Crooksville, Ohio; died in Frankfort, Germany, August 26; aged 42. Dr. Bondy was a captain in the U. S. Army Dental Corps.

Bowman, James Edward, Knoxville, Tenn.; died August 15.

Boyd, James Thompson, Brewton, Ala.; Baltimore College of Dental Surgery, 1902; died September 6; aged 68.

Bradley, George H., Tarzana, Calif.; Creighton University, College of Dentistry; died July 14; aged 39.

Brady, Louis A., Newark, N. J.; Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania, 1901; died August 25; aged 69.

Brooks, Elmer E., Salem, Ore.; died September 12; aged 71.

Brown, Clark W., Altoona, Pa.; Temple University School of Dentistry, 1891; died in August.

Cage, Alva D., San Diego, Calif.; Vanderbilt University, School of Dentistry, 1895; died July 25; aged 72.

Carter, Isaac S., Council, Idaho; Ohio College of Dental Surgery, Dental Department of the University of Cincinnati, 1890; died August 14; aged 82.

Caval, Valdeman, Los Angeles, Calif.; died August 13; aged 77.

Coen, Albert E., Mt. Vernon, Wash.; Western Dental College, 1908; died September 15; aged 53.

Cohn, Charles, Philadelphia, Pa.; Temple University School of Dentistry, 1925; died August 19; aged 42.

Collins, Frank E., Cambridge, Mass.; Tufts College Dental School, 1921; died August 29; aged 61.

Criner, Bolin, Fort Smith, Ark.; St. Louis University School of Dentistry, 1915; died August 8; aged 58.

Dawley, Henry A., Jackson, Mich.; University of Michigan, College of Dental Surgery, 1886; died August 17; aged 85.

Devlin, William, Arthur, Ill.; Northwestern University Dental School, 1904; died August 30; aged 65.

Donelan, John J., Springfield, Ill.; Chicago College of Dental Surgery, Dental Department of Loyola University, 1905; died September 9; aged 63.

Elzey, W. James, Washington, D. C.; George Washington University, Dental Department, 1904; died August 1; aged 65.

Engel, Walter F., Brooklyn, N. Y.; The New York College of Dentistry, 1904; died September 29; aged 65.

Flagg, Charles E., Buffalo, N. Y.; University of Buffalo, School of Dentistry, 1895; died August 21; aged 80.

Fluck, Franklin S., Philadelphia, Pa.; Temple University School of Dentistry, 1907; died September 3; aged 60.

Foster, H. C., Berkeley, Calif.; Pennsylvania College of Dental Surgery, 1900; died August 6; aged 70.

Fouch, Ranthus B., Minneapolis, Minn.; University of Minnesota, College of Dentistry, 1914; died August 27; aged 52.

Franchere, Harold A., Lake Crystal, Minn.;

Marquette University, School of Dentistry, 1915; died September 7; aged 57.

Frank, Peter, Paterson, N. J.; Temple University School of Dentistry, 1918; died August 25; aged 53.

Gault, James Conley, St. Louis, Mo.; Barnes Dental College, Dental Department, St. Louis, 1906; died July 30; aged 62.

Geib, William A., Springfield, Ohio; Ohio State University, College of Dentistry, 1912; died July 13.

Gilmore, John Irving, Youngstown, Ohio; Western Reserve University, School of Dentistry, 1900; died September 16; aged 77.

Hadley, Grant S., Coldwater, Mich.; University of Michigan, College of Dental Surgery, 1897; died August 21; aged 74.

Handler, Bernard S., Harrisburg, Pa.; Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania; died July 12; aged 36.

Harmon, Virgil E., Gainesville, Texas; died July 25; aged 68.

Harvey, J. B., New Orleans, La.; died August 10; aged 74.

Hatfield, Marcellus S., Lancaster, Ky.; Ohio College of Dental Surgery, Dental Department of the University of Cincinnati, 1915; died June 29; aged 59.

Hoffman, Warren B., Columbia, Pa.; died August 4; aged 40.

Holland, John C., Darlington, Wis.; Marquette University, School of Dentistry, 1918; died August 17, aged 48.

Hollister, F. W., Portland, Ore.; North Pacific College of Oregon, School of Dentistry, 1904; died June 25.

Hutchins, Warren B., Lake Ronkonkoma, N. Y.; died July 2; aged 69.

Hutchinson, Robert George, Jr., Essex Falls, N. J.; New York College of Dentistry, 1889; died September 23; aged 78.

Jones, Clement R., Pittsburgh, Pa.; died September 4; aged 74.

Kelley, Emma Elaine, Lackawanna, N. Y.; University of Buffalo, School of Dentistry, 1919; died August 22.

Ketchum, W. Clair, Yakima, Wash.; North Pacific College of Oregon, School of Dentistry, 1907; died July 28.

Klobuchar, Frederick J., Calumet, Mich.; Marquette University, School of Dentistry; died August 19.

Komar, Joseph J., Milwaukee, Wis.; Marquette University, School of Dentistry; died August 11; aged 41.

Law, Lewis, Minneapolis, Minn.; University of Minnesota, College of Dentistry; died August 29; aged 29.

Leslie, Raymond C., Cambridge City, Ind.; Indiana University School of Dentistry, 1901; died August 29; aged 68.

Linville, Robert R., Mt. Olivet, Ky.; University of Louisville, School of Dentistry, 1919; died August 10; aged 47.

Locke, William Stanton, Cincinnati, Ohio; Ohio College of Dental Surgery, 1891; died September 18; aged 80.

Loebenstein, Samuel, Kansas City, Mo.; Temple University School of Dentistry, 1892; died August 13; aged 74.

Madison, William J., Washington, D. C.; Ohio State University, College of Dentistry, 1925; died August 16; aged 45.

Mally, James W., Mentor, Ohio; Ohio College of Dental Surgery, Dental Department of the University of Cincinnati, 1921; died August 13; aged 46.

Marshall, Burt John, Marks, Miss.; University of Tennessee, Dental Department, 1901; died July 10; aged 70.

Miller, George L., King City, Mo.; Washington University School of Dentistry, 1895; died August 10; aged 73.

Monteith, James A., Philadelphia, Pa.; Pennsylvania College of Dental Surgery, 1904; died September 19; aged 71.

Moore, Arthur T., St. Joseph, Mo.; Northwestern University Dental School, 1901; died August 2; aged 78.

Moore, C. L., Plainfield, N. J.; Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania, 1902; died September 25; aged 64.

Myra, Bert O., Silver City, N. M.; Marquette University School of Dentistry; died September 30; aged 48.

Newell, Harmon, Claremont, N. H.; Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania, 1900; died September 20; aged 69.

Nordin, Emil N., Rush City, Minn.; University of Minnesota, College of Dentistry, 1909; died in July; aged 64.

O'Brien, Cornelius A., St. Louis, Mo.; St. Louis University School of Dentistry, 1912; died July 25; aged 55.

Orr, George O., St. Paul, Minn.; Chicago

College of Dental Surgery, 1897; died September 3; aged 76.

Parmley, Myron F., Jacksonville, Fla.; died September 2; aged 86.

Pelzer, George W., Great Falls, Mont.; died September 2; aged 80.

Perkins, Earl R., Manitowish, Wis.; died June 29.

Risacher, Eugene M., Loogootee, Ind.; Indiana University School of Dentistry, 1905; died August 31; aged 68.

Risser, C. H., North Manchester, Ind.; University of Tennessee, College of Dentistry, 1894; died August 19; aged 81.

Roberts, A. W., Lenoir City, Tenn.; Vanderbilt University, School of Dentistry, 1904; died June 2.

Rutland, Neale M., Nashville, Tenn.; Vanderbilt University, School of Dentistry, 1901; died August 26; aged 61.

Saunders, Boyd G., Rochester, N. Y.; Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania, 1881; died September 1; aged 86.

Schafer, Nathan, Pittsburgh, Pa.; University of Pittsburgh, School of Dentistry, 1923; died September 14.

Schall, John Sidney, Omaha, Nebr.; Creighton University Dental School, 1916; died June 19.

Schneberger, Joseph P., Ossian, Iowa; Creighton University, College of Dentistry; died July 4.

Schwartzbek, Court C., Bryan, Ohio; University of Michigan, College of Dental Surgery, 1914; died August 29; aged 54.

Scott, William C., Lansford, Pa.; Pennsylvania College of Dental Surgery, 1897; died July 19.

Seever, Earl S., Belle Plaine, Kan.; Kansas City-Western Dental College, 1927; died September 11.

Sibbitt, Carl W., Frankfort, Ind.; Indiana University School of Dentistry, 1919; died September 6.

Smith, Charles L., Tulare, Calif.; College of Physicians and Surgeons of San Francisco, A School of Dentistry, 1899; died August 21; aged 84.

Spain, C. J., Beloit, Kan.; Kansas City Dental College, 1907; died May 1; aged 63.

Tench, J. D. L., Gainesville, Fla.; Baltimore College of Dental Surgery, 1896; died August 11; aged 76.

Tifft, Lewis W., Minneapolis, Minn.; University of Minnesota, College of Dentistry, 1923; died August 26; aged 47.

Treiber, George R., Escanaba, Mich.; Chicago College of Dental Surgery, Dental Department of Loyola University, 1906; died September 19; aged 64.

Vawter, Ray A., Washington, D. C.; died September 7; aged 42.

Walker, Robert M., Chicago, Ill.; Vanderbilt University, School of Dentistry, 1899; died August 30; aged 78.

Watkins, Carl L., Chicago, Ill.; University of Illinois, College of Dentistry, 1911; died September 8; aged 55.

West, Noland Smith, Houston, Texas; died September 12; aged 71.

Wilcox, Delbert E., Oconto, Wis.; died July 7; aged 90.

Wolfe, Allen Scott, Los Altos, Calif.; died September 25; aged 62.

Workman, Robert L., Miami, Fla.; died August 23; aged 72.

Yeckley, William E., San Francisco, Calif.; died in Hammond General Hospital, Modesto, Calif., August 1. Dr. Yeckley was a lieutenant in the U. S. Army Dental Corps.

Young, Charles W., Lake Forest, Ill.; Northwestern University Dental School, 1908; died September 13; aged 64.

Youngs, Andrew D., Amsterdam, N. Y.; Baltimore College of Dental Surgery, 1891; died August 22; aged 75.

MEETINGS AND ANNOUNCEMENTS

American Academy of Periodontology Council, Chicago, Ill., February 9, 1946. Raymond E. Johnson, 824 Lowry Medical Arts Bldg., St. Paul 2, Minn., Secretary.

Association of Military Surgeons, Detroit Chapter, Detroit, Mich., October 9-11, 1946. Carleton Fox, 557 David Whitney Bldg., Detroit 26, Secretary.

Colorado: Denver Dental Association, January 6-9, 1946. Harry A. Stewart, 919 Republic Bldg., Denver 2.

Delaware: State Board of Dental Examiners, Wilmington, December 12-14. Charles R. Jefferis, Medical Arts Bldg., Wilmington, Secretary.

Dental Protective Association of the United States, Chicago, Ill., December 17. W. Ira Williams, 122 South Michigan Ave., Chicago 3, Secretary.

District of Columbia: Dental Society, Washington, second Tuesday of each month. J. Walter Bernhard, 1835 Eye St., N.W., Washington, Secretary.

Illinois: Chicago Dental Society, February 11-14, 1946. Robert J. Wells, 30 North Michigan Ave., Chicago 2, Secretary.

Massachusetts: Board of Dental Examiners (dentists and hygienists), Boston. December 17-19. John C. Wilson, State House, Boston 33, Secretary.

Dental Society, Boston, May 6-9, 1946. Stephen P. Mallett, President.

Minnesota: State Dental Association, St. Paul, February 25-27, 1946. L. M. Cruttenden, 498 Lowry Medical Arts Bldg., St. Paul 2, Secretary.

New York: Dental Society of State of, New York City, May 13-16, 1946. Charles A. Wilkie, Secretary.

Greater Dental Meeting, December 3-7. Willard S. Bell, Room 106A, Hotel Pennsylvania, New York, Chairman, Press and Publication.

North Carolina: State Board of Dental Examiners, Raleigh, April 1, 1946. Wilbert Jackson, Rich Bldg., Clinton, Secretary.

Pennsylvania: Greater Philadelphia Annual Meeting, February 5-7, 1946. Abram Cohen, 269 South Nineteenth St., Philadelphia 3, Chairman, Publicity Committee.

State Dental Society, Pittsburgh, May 7-9, 1946. C. J. Hollister, 217 State St., Harrisburg, Executive Secretary.

Tennessee: Board of Dental Examiners, Memphis, December 10-14. James J. Vaughn, Medical Arts Bldg., Nashville 3, Secretary.

West Virginia: State Board of Dental Examiners, West Liberty, June 24-27, 1946. R. H. Davis, Clarksburg, Secretary.

Wisconsin: State Dental Society, Milwaukee, March 25-27, 1946. Kenneth F. Crane, Bankers Bldg., Milwaukee 2, Executive Secretary.

Pan American Odontological Association: New York, N. Y., December 5. Ralph Howard Brodsky, 14 East Eighty-First St., New York 28, Executive Secretary.

Puerto Rico: Dental Society, San Juan, January 31-February 3, 1946.

Internships, Externships, Residencies and Fellowships

Eastman Dental Dispensary, Rochester, N. Y. Director, Harvey J. Burkhart.

Research and Educational Hospital, University of Illinois Medical Center. Address Dean, University of Illinois, College of Dentistry, 808 S. Wood St., Chicago 12.

Richmond Freeman Memorial Clinic for Infants and Children, Dallas, Texas. Dora B. Foster, 3617 Maple Ave., Dallas, Executive Director.

Walter G. Zoller Memorial Dental Clinic, University of Chicago. Address Director, Walter G. Zoller Memorial Dental Clinic, University of Chicago, Chicago 37.

Carnegie Fellowships for Research and Graduate Work in the Dental Sciences, University of Rochester, George H. Whipple, Rochester, Dean.

Pathology, Dental and Oral, Fellowship in, Army Institute of Pathology. Address Director, American Registry of Pathology, Army Institute of Pathology, Army Medical Museum, Seventh and Independence, S.W., Washington 25, D. C.

Greater New York Dental Meeting to Be Held December 3-7

The First and Second District Dental Societies of the Dental Society of the State of New York will hold their twenty-first annual Greater New York Dental Meeting at the Hotel Pennsylvania, New York City, December 3-7. Willard S. Bell, vice-chairman, states that the meeting will feature most of its prewar attractions. These include registered clinics, table clinics, visual education displays, topic discussions and an essay program. There will also be the usual program of exhibits of various types.

Confirmed Hotel Reservations Essential for Midwinter Meeting

Confirmed hotel reservations will be essential for all of those who are planning to attend the annual Midwinter Meeting of the Chicago Dental Society, which will be held at the Stevens Hotel, February 11-14. Hotel congestion in Chicago will continue at its peak rate well into next year, and L. Russell Hegland, executive secretary of the Chicago Dental Society, warned that it might not be possible to secure accommodations in Chicago or neighboring cities unless confirmed reservations were secured prior to coming to Chicago.

Denver to Hold Midwinter Meeting on January 6-9

The Denver Dental Association will hold its annual Midwinter Dental Meeting on January 6-9, 1946, according to a recent announcement by the secretary, Harry A. Stewart. Headquarters will be maintained at the Cosmopolitan Hotel.

Three States to Hold Annual Meetings During January

The state dental societies of Delaware, Rhode Island and Washington have scheduled annual meetings for January. The Delaware State Dental Society will hold its meeting January 9 at the Academy of Medicine, Wilmington. The Rhode Island State Dental Society will hold its annual meeting in Providence on January 22-23 at the Narragansett Hotel. The Washington State Dental Association will meet in Seattle at the Olympic Hotel on January 31-February 2.

Erratum

Through an inadvertence, the names of the authors of "The Development of Acrylic Eye Prosthesis at the National Naval Medical Center," in the October 1, 1945, issue, page 1227, were not given in the proper order. The senior author was Phelps J. Murphey, D.D.S., who is now on terminal leave from the Navy. His new address is: 3702 Fairmount Ave., Dallas, Texas.

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